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GRAMMAR OF THE CHOCTAW LANGUAGE.

PREPARED BY THE REVEREND CYRUS BYINGTON, AND EDITED BY DR. BRINTON.

Read before the American Philosophical Society, Feb. 4, 1870.

INTRODUCTION.

The Choctaw, or properly Chahta nation, numbers at present about 17,000 souls, 4,500 of whom are Chickasaws. When first known to Europeans these allied peoples occupied the territory on the left bank of the Mississippi, almost from the Ohio river to the Gulf. They belong to the great CHAHTA-MUSKOKEE family, which, in early days, controlled the whole country from the Mississippi to the Atlantic, and from the Gulf shore to the Apalachians.

The Choctaws have always been quick to adopt the instruction of their civilized neighbors, and at present have about seventy schools with nearly two thousand pupils on their reservation.[1] During the French occupation of Louisiana, in the early part of the last century, efforts were made by the Roman Catholic missionaries to convert them, but without success.[2] In 1818, Protestant missionaries were sent among them, who effected a permanent impression upon them, and were mainly instrumental in bringing about their present highly creditable condition. Their evil habits were reformed, they were instructed in agriculture, and their language was reduced to writing. In the latter, the alphabet suggested by the Hon. John Pickering, in his essay "On a uniform orthography of the languages of the Indians of North America," was employed. The first book printed was a spelling book, by the American Tract Society, in 1825. Since that time, besides a large number of tracts, almanacs, hymn books, and educational works, the whole of the New Testament and most of the Old Testament have been printed in the language, by the American Bible Society, New York city, after faithful translations by the Rev. Cyrus Byington and the Rev. A. Wright, assisted by educated natives.[3] These can readily be obtained, and will be found of great service in elucidating the grammatical structure of the language, as it is for the first time explained in the present work by the hands of the REV. CYRUS BYINGTON.

This eminent scholar and missionary, whose name is inseparably connected with the later history of the Choctaw nation, was born at Stockbridge, Berkshire county, Massachusetts, March 11, 1793. He

[1] Report of the Commissioner of Indian Affairs, for 1869, p. 37.

[2] Shea, History of Catholic Missions in the United States, p. 441.

[3] In comparing the translation of the Four Gospels, second edition, 1845 (Boston, printed for the A. B. C. F. M.), with the second edition of the New Testament by the American Bible Society (New York, 1854), I find a number of slight differences, especially in the use of the neutral vowel v.

was one of nine children, and his parents were in humble circumstances, but industrious and respected. His father was at one time a tanner, and subsequently a small farmer. Necessarily, therefore, his early education was limited.

When a well grown lad he was taken into the family of Mr. Joseph Woodbridge, of his native town, from whom he received some instruction in Latin and Greek, and with whom he afterward read law. In 1814 he was admitted to the bar, and practiced a few years with success in Stockbridge and Sheffield, Mass.

His father though a moral was not a religious man, and it seems to have been only after he reached manhood that Mr. Byington became, as he expressed it, "a subject of divine grace." He then resolved to forsake the bar and devote himself to missionary life. With this object in view he entered the theological school at Andover, Mass., where he studied Hebrew and theology, and was licensed to preach, September, 1819. At this time he hoped to go to the Armenians in Turkey. But Providence had prepared for him another and an even more laborious field.

For about a year he preached in various churches in Massachusetts, awaiting some opportunity for missionary labor. Toward the close of the summer of 1819, a company of twenty or twenty-five persons left Hampshire county, Mass., under the direction of the American Board of Missions, to go by land to the Choctaw nation, then resident in Mississippi. They passed through Stockbridge, in September, and were provided with a letter from the Board, asking Mr. Byington to take charge of them, and pilot them to their destination. He was ready at a few hours' notice.

The company journeyed by land to Pittsburgh, where they procured flat boats, and floated down the Ohio and Mississippi to a point near the mouth of the Yalobusha river, whence a land journey of two hundred miles brought them to their destination.

Thus commenced Mr. Byington's missionary life among the Choctaws. It continued for nearly fifty years, and resulted, with the blessing of Providence and the assistance of some devoted co-workers in the Nation, especially the Rev. A. Wright and the Rev. Cyrus Kingsbury, in redeeming the nation from drunkenness, ignorance and immorality, to sobriety, godliness, and civilization. There are no lives which in the eyes of the philanthropist are more worthy of admiration, or more deserving of record than those of such men, who not only rescue thousands of individuals from spiritual and physical degradation, but preserve with enlightened care the only memorials of whole nations.

For throughout his missionary life Mr. Byington appreciated the value which a knowledge of the language and traditions of the Choctaws would have to scholars. From his arrival among them, there-

fore, he devoted assiduous labor to their language with a view to comprehend its extremely difficult construction, and to render it available for the missionary and philological student. The first draft of his Grammar was completed in 1834. It was written and re-written, until at the time of his death, which occurred at Belprè, Ohio, December 31st, 1868, he was at work upon the seventh revisal. This had proceeded as far as the close of Part I. This much, therefore, of the Grammar is almost precisely as the author left it.

Part II. commencing with the Article-Pronouns, I have arranged from the manuscripts of the fifth and sixth revisals, deposited in the library of the American Philosophical Society at Philadelphia, by the family of the author.

In undertaking this task I have throughout adhered closely to the language and arrangement of the original, even where a different nomenclature and an altered arrangement suggested themselves, as in better accordance with modern philological views. It is, I think, more proper to maintain strict fidelity to the forms chosen by so thorough a Choctaw scholar as the Rev. Mr. Byington, in the explanation of so difficult a tongue, than to run any risk of misrepresenting his views by adopting a more modern phraseology.

Mr. Byington's own views of what he had accomplished deserve recording. In his diary under date March 11, 1864 (his birthday), he writes:

"The last year I revised the Choctaw Grammar, going over the ground twice. The last effort I hope is my best, and will be of use to learners of Choctaw, and to Choctaw scholars in schools, but it needs further revision, and then to be well transcribed. I commit these efforts in my old age to the Lord. I have enjoyed these labours very much. The pleasure of happily resolving difficulties in these studies, and of success in the work, is gratifying, and reviving to the mind."

In 1867 he wrote:

"This work can be much improved hereafter by other hands. It may be compared to the first survey and making of a road in a new country."

In spite of these deficiencies, of which no doubt the author was more distinctly aware than any one else, his Grammar remains one of the most valuable, original, and instructive of any ever written of an American language. It is the result of nigh half a century of concentrated study, and we may well doubt if ever again a person will be found who will combine the time, the opportunities, and the ability to make an equal analysis of the language.

Mr. Byington also prepared a Choctaw dictionary, containing about 15,000 words, which remains in manuscript, in the possession of his family.

In commencing the study of Choctaw, those accustomed only to English and cognate languages will discover many peculiarities. Some of them are as follows:

1. The want of the verb "to be" as a declinable word.
2. The want of personal pronouns in the third persons, singular and plural.
3. The want of a plural form in many nouns, verbs and adjectives.
4. The irregular manner in which the plural is made.
5. The want of a passive voice in some verbs, and its irregular formation.
6. The order of words in a clause or sentence.
7. The use of pre-positive particles, or prefixes.
8. The use of post-positive particles, or suffixes.
9. The use of fragmentary pronouns, simple and compound.
10. The repetition of pronouns.
11. The numerous ground-forms of the verbs, arising from internal changes in the primary root.
12. The negative forms of verbs, adjectives, and fragmentary pronouns.
13. The causative forms of verbs.
14. The internal changes in the causative forms.
15. The uniformity of grammatical forms and structure.
16. The extent to which the rough aspirate h supplies the want of the verb of existence.
17. The difficulties in resolving and translating the article-pronouns.

PART FIRST.

ORTHOGRAPHY.

1. THE ALPHABET.

Consonants, vowels, diphthongs, nasals, and aspirates are used.

Letters.	*Names and values.*
A a	a or ah, a broad, as in father.
V v	ă short, as a in vial, or u in sun.
B b	be
Ch ch	che
E e	a long, as in made, or e in there.
F f	fe
H h	he
Hl hl	hle

I i	e as i in marine, and short as i in pin.
K k	ke
L l	le
M m	me
N n	ne
O o	o as in note.
P p	pe
S s	se
Sh sh	she
U u	oo as in took, or u as in full.
W w	we
Y y	ye.

Nasals: ą, ę, ų, į.

2. REMARKS ON THE ALPHABET.

The vowel v has heretofore been called ŭ short. But the Choctaws give it the sound of ă short, and when lengthened it passes into ā long; as, vbi, to kill; abi, to kill.

Hl, hl, is an aspirated l, when at the beginning of a syllable; when it closes a syllable, it is lh; as, hlibata, a buckskin thong; tulhko, buckskin leather.

H, h, has two sounds, one a smooth aspirate, as in hina, a road; the other rough, as in tahli, to finish.

K, k, has two sounds, one sharp, as in oka, water; the other rough, as in the article-pronoun okvt, oke. In order to express the sound fully, the latter might be spelled okhvt, okhe.

The vowels have the continental sounds.

The diphthongs are: ai, pronounced as i in pine; and au, as ow in now.

3. THE NASALS.

These are not represented by independent letters, but by a line drawn under the vowels, thus: ą, į, ę, ų, pronounced ang, ing, ong, ung, with slight variations depending upon the next succeeding consonant.

v nasalized, passes into ą.
e " " " į.
ai " " " ąy, as falą̇iya, to be long, falą̇ya, being long.
au " " " ąw, as laų̇a, to be many, lą̇wa, being many.

The nasal sounds increase the distinctive power of the words in which they occur. For instance, the article-pronouns **a** definite and **o** distinctive are made more definite and distinctive by the nasal mark. This is also true of adverbs of affirmation and negation; verbs and adverbs take the nasals as intensives; ą, yes it is; hą, no it is not; keyų, no it is not; chito, large; chįto, being large, the large one. The nasal sound implies emphasis, and distinctiveness by comparison.

4. SOUNDS WANTING.

The consonants c, d, g, j, q, r, v, x, and z, are absent in Choctaw. Double consonants, such as br, dr, tl, bt, nt, st, are of difficult articula-

tion to the natives. When such sounds occur in proper names, as in the Bible, they substitute others, as follows: for c soft they use s, as Cyrus, Sailas; for c hard, k, as Canaan, Kenan; for ch hard, k, as Enoch, Enak; for d, l, as David, Lewi; or else t, as Daniel, Taniel or Tanili; for g soft and for j, ch, as Gentile, Chentail, Jew, Chu; for g, ko or ku, as queen, kuwin, or kowin; for r, l, as Rachel, Lechel, but at the end of a syllable it is dropped, as Peter, Peta; for v, f or w, as Levi, Lefai, David, Lewi; for x, ks, as Exodus, Eksotus; for z, s, as Zaccheus, Sakevs. When two consonants come together, a short vowel is sometimes inserted, or one is prefixed: as, wheat, wohet; Andrew, Antilu; bridle, bilitel; Stephen, Istifin; Reid, Olit.

5. CONTRACTIONS.

Contractions by the elision of vowels or consonants are frequent in both simple and compound words and phrases. A few examples are given:

chuka a̲y ont antah, for onvt antah, he goes to and stays at the house.
anont a̲ya, for anolit a̲yah, he goes along and tells it.
bot vbi, for bolit vbih, he beats and kills.
chukachvfa, for chuka achvfa, a family.
chukfushe, for chukfi ushi, a lamb.
issakshup, for issi hakshup, a deer skin.
siaknip, for sa haknip, my body.

6. CONSONANT CHANGES.

The following change of the consonants may take place: ch may change to sh: ochiah, she draws water; oshtiah, she goes to draw water; tanchi, corn, tashishi, corn-fodder. Sh may change to t, as in the article-pronoun osh, ot. K and t, and l and m, are interchangeable in a few words: as ikhana to ithana, to know; oktvni to ottvni, to appear; omba to oma, to rain; yukpa changes to yuppa, to be pleased.

7. VOWEL CHANGES.

a̲ shortened becomes v, as chumpa, to buy, chumpvt iah, he goes to buy.

e̲ shortened becomes i, as emah, imah, he gives.

o̲ shortened becomes u, as tok, tuk, it was, hommah it is red, hummah it is reddish.

v lengthened becomes a.

ĭ lengthened becomes e, as pisah, pesah, he sees.

ŭ lengthened becomes o.

o in holissoh becomes i in hollisichih, he writes.

a in momah becomes i in mominchih.

8. NASAL CHANGES.

Exact rules for these changes are not easily given. The nasals a̲, i̲, o̲, u̲, stand before the consonants f, h, hl, k, n, s, sh, w, and y; as i̲ fuli, his switch; i̲ hollisso, his book; i̲ kana, his friend; i̲ wak, his cow; i̲ yuka, his prisoner. The nasal marks are changed to the letter m before the diphthongs, the vowels, and the consonants b, m, and p; and to the letter

n before ch, lh, l, and t; but to these rules there are exceptions; as, imi shilombish, his spirit; i ponaklo, to inquire of him; nan anoli, an informer; nan illi, death. The position of the organs of speech preparatory to the utterance of the succeeding letter causes a change in the nasal sound; as, i wak, his cow; im issuba, his horse; in chuka, his house.

9. DOUBLED CONSONANTS.

Consonants are doubled in the intensive form of verbs and adjectives; as,

alota, to be full.	vllota, to be quite full.
anoa, to be reported.	vnnoa, to be commonly reported.
anumpa, to be spoken.	vnnumpa, to be much spoken.
himak, now.	himmak, hereafter, after all.
pila, thither.	pilla, away there.
kvnia, gone.	kvnnia, really gone.

When the consonant y is doubled, the first one is transformed into i; as,

hoyo, to look for.	hoiya, to look for earnestly.
ayukpa, to be glad of.	aiyukpa, to be very glad of.
ayohmi, to do so there.	aiyohmi, to do so really.

10. SYLLABIFICATION.

Syllables usually terminate in a vowel sound, but may end with a consonant. When two simple consonants occur in the same word, the first ends one syllable and the second commences the succeeding one; as, bvnna, to want; tobbi, to be white. The double consonants ch, sh, hl, and lh, are inseparable. The long vowels have their full sound in all accented syllables, except the vowel i, which is occasionally short, as in sipsi, a poplar, ilh, to die. In words of two or more syllables the accented syllable takes a consonant, which is heard in both syllables; as, hina, a word, pronounced hinna. In some words the consonant is doubled; as, illi, to die; putta, all. In a few instances the mark ′ has been used to indicate emphasis and the imperative mood; as, Luke X. 37, i nukhaklo tok a′, he that showed mercy on him.

11. ACCENT.

In words of two or more syllables the penult is accented; as, kan′chi, to sell; ano′li, to relate. In words of four or more syllables there is a secondary accent on the second syllable before the penult; as, po′hlomo′li, to double them up; anum′pohon′li, to keep talking. There is another accent which falls on the final syllable of such words as in English are followed by marks of punctuation, from the comma to the period. It is called the pause accent. Consonants take the accent merely, while final vowels take the rough aspirate h suffixed.

12. DIVISION OF WORDS.

All simple words are written separately. There are, however, words compounded with prefixes, suffixes, and inseparable pronouns, which are written as one. But to avoid confusion, whenever it is possible, the elements of each clause are written and printed separately.

13. ARRANGEMENT OF WORDS IN A SENTENCE.

1. The connective.
2. The subject and its modifications.
3. The object and its modifications.
4. The verb or predicate, with its modifications.
5. Time when comes both before and after the subject.

Time how long is similarly placed, and also at the close of the sentence; Luke I. 24; IV. 25.

6. Instrument and means, with modifications, precede the verb.
7. Adjectives follow nouns.
8. Adverbs follow verbs, adjectives, and adverbs.
9. Infinitives precede the word on which they depend.
10. The place where, comes next after the time when.
11. The imperative follows the noun which is its object; Luke I. 3, 9.
12. The predicate is often at or near the close of the sentence. See Mat. V. 1—12 verses.

PART SECOND.

GRAMMATICAL FORMS AND INFLECTIONS.

PARTS OF SPEECH.

There are in Choctaw nine sorts of words, or parts of speech, namely:

1. Article-pronouns, or post-positive particles.
2. Pronouns, or substitutes.
3. Verbs.
4. Prepositions, or pre-positive particles.
5. Nouns, or names.
6. Adjectives, or attributes.
7. Adverbs, or modifiers.
8. Conjunctions, or connectives.
9. Interjections, or exclamations.

CHAPTER I.

THE ARTICLE-PRONOUNS.

§ 1. This is the most difficult part of Choctaw Grammar. The want of separate words corresponding to the English articles, of the personal pronouns in the third persons singular and plural, the relative pronouns single and double, and the copulas, is much felt by Americans in studying this language. The article-pronouns are used to supply these wants in a great variety of ways. They do not always admit of a translation. They often merely indicate the case of a word or clause. An accurate and full explanation of them is not attempted. Only a few leading remarks and rules are presented.

§ 2. The use of the article-pronouns is for definite and distinctive specification, limitation, emphasis, and prominence, and to show the connection and relation which one word, paragraph, or clause bears to another.

§ 3. They are placed after nouns and pronouns with their attributes, after verbs, adverbs, and their attributes, after prepositions and conjunctions. They are definite, distinctive, and contradistinctive, subjective, objective, and copulative. A part of speech can take more than one at a time.

§ 4. They may be translated by (1) the articles a, an, the, (2) the adjective pronouns one, ones, some, (3) the personal pronouns he, she, it, they, in the nominative case, and him, her, it, them, in the oblique case, (4) the relatives who, which, what, that, in the nominative case, and whom, which, what, that in the oblique case, (5) by the double relatives he who, she who, that which, and they who, (6) and by the one who, the ones who, and the ones whom. Often they are not to be translated in English.

§ 5. The primary or ground forms of the article-pronouns are **a** definite, and **o** distinctive. They are used (1) as articles, (2) as personal pronouns in the third persons singular and plural, (3) as relative pronouns, single and double, in both numbers, (4) as adjective pronouns, (5) as copulas.

§ 6. **a** is definite, and when used as an article is much like the English article *the*, though it is also translated by a, or an. **o** is distinctive, and corresponds to the indefinite *a* or *an* in English, or to the adjective pronouns one, ones, some. **a** implies certain knowledge, while **o** ignores other objects and does not make certain the objects it specifies otherwise than that they belong to one species or kind. **o** is emphatic. Both are used for specification, emphasis, and case.[1]

§ 7. In the oblique case nouns are sometimes found without either of them. And when they are used, they may be rendered by either of the articles, or as mentioned above.

§ 8. The article-pronouns have (1) variations, and (2) modifications.

§ 9. **a** DEFINITE.

a may be varied by becoming v, e, or i.

It is modified by suffixing various letters, which alter its signification, thus :

---

[1] *Definite and Distinctive.* — These two forms of speech run through the whole language, and modify not only article-pronouns, nouns, verbs, and conjunctions, but even clauses and sentences. Mr. Byington explains the double plural of the personal pronoun of the first person, common to nearly all American languages, and generally known as the exclusive plural (excluding the second person) and inclusive plural (including the second person, with or without the third person), the former as definite, the latter as distinctive. These plurals, he says, "correspond to **a** definite and **o** distinctive;" and of the separable personal pronouns, vno and sia, he says, "the difference between them is similar to that between **a** and **o**." The distinctive expresses in its broadest sense the signification of the word or clause, but lends an emphasis which *distinguishes* it from any word or clause of allied purport; the definite *defines* or limits the signification to some specific, known word, individual, or act. Vno, I, distinctive, begins a sentence, the speaker being as yet vague; but as soon as the speaker is defined by a verb, adjective, or other qualifying word, the pronoun changes to sia, I, definite. Vhli, definite, edge, limit, to be the edge or limit of anything, to bound it; this signification is extended in the distinctive form ahli, to be the whole of anything, hence to be true, truth.

It adds t, to form the nominative case, at, vt, et, it;
a nasal sound, to form the oblique case, ą, į;
h, to form an affirmative (predicate definite), ah, it is the;
h, and varies to e, to form an affirmative (predicate absolute), eh, it is;
k, to form a determinate definite, ak, the, that; and kvt, ket, kit;
sh, to form a renewed mention definite, ash, vsh, the said, the same;
mo, to form a renewed mention distinctive, amo, vmo, the ones.

It prefixes m in mvt, ma, mak, to express a simultaneous, or concomitant object or act, the too; *e. g.* Luke XVI. 25, Svso ma! Son! (*i. e.* thou, too, my son).

§ 10. o DISTINCTIVE.

o is modified in a similar manner.

It adds sh, t, or cha, to form the nominative, osh, ot, ocha;
a nasal to form the oblique case, ǫ, ona;
h, to form an affirmative (predicate distinctive), oh, that is so;
k, to form a determinate distinctive, ok, that one is so;
sh, to form a renewed mention distinctive, osh, the said ones;
mo, to form a renewed mention concomitant, omo, the said ones, too;
kh, to form an optative, okh, oh, that it were so;
km, to form a conditional, okm, if it were so;
keh, to form an affirmative contradistinctive, okeh, it is so and not otherwise;
t, cha, and na, to form connectives.

§ 11. The definite and the distinctive are both used separately after one subject, and then the definite follows the noun, and the distinctive its modification. Thus John III. 1, Hatak vt Falisi yosh, a man who was a Pharisee; Luke X. 39, itibapishi hvt Meli hohchifo hosh, a sister whose name was Mary. The distinctive may also be used first, and the definite follow the modification; Luke XI. 27, ikfoka yvt yummak osh, the womb that.

§ 12. These two article-pronouns and their modifications combine with each other to form the third class, the CONTRADISTINCTIVES.

§ 13. THE CONTRADISTINCTIVES.

The definite a in combination with the distinctive o:

at, et, vt, take o to form a contradistinctive a, to, eto, uto, nom. case.

ą in the oblique case changes to an and takes o, ano, vno.

ak takes o to make the determinate contradistinctive, ako.

mak takes o to make a simultaneous or successive contradistinctive, mako.

mvt in the nominative case takes o to form a contradistinctive, mvto.

mą in the oblique case becomes man, and takes o, mano.

ak becomes ok in ak ok, for intensity of specification.

mak takes ok in mak ok, for the same reason.

a takes mo to form a definite and indeclinable renewed mention in recent past time, as Luke XVI. 13, achvfa kamo, the one.

The distinctive **o** in combination with the definite **a** :

ok takes vt in okvt, nom. case, contradistinctive.

ok takes a in oka, oblique case.

ok takes ah in okah, a distinctive and definite predicate.

ok takes eh in okeh, a distinctive and absolute predicate.

ok takes ato, vta, in okvta, nom. and okanto.

ok takes ano or vno in okvno, oblique case.

ok takes ak in okak, to double the definitive force of the pronoun.

ok ak takes the pronoun o in okakosh, okako, as a strong definite and concessive, Mark XV. 31.

o takes mo in omo, renewed mention in the remote past tense, indeclinable.

§ 14. The following table presents the values and significations of the article-pronouns and their modifying particles, in a brief and comprehensive manner :

a, v, e, i, definite, implying knowledge of the thing, act or individual named ; as, wak a, the cow, not a or some cow.

o, distinctive, generic, implying kind and ignoring other objects, but not rendering the thing, act, or individual certain. It does not specify particular objects, but merely distinguishes them ; as, wak o, a cow, not a horse.

ch, connective, and.

h, predicative or affirmative, the sign of existence.

k, determinate or demonstrative, that, the.

kb, optative, wishing it were so, oh that ; definite ; the distinctive form is okb.

km, suppositive, conditional, or contingent, if, when, provided ; definite ; the distinctive form is okm.

m, successive, simultaneous, compellative, when, then, also, too, oh.

mo, renewed mention distinctive, the same, the said ; omo, remotely past ; amo, recently past.

sh, renewed mention definite of recent past time.

shkeh, definite affirmation, it is.

okeh, distinctive affirmation, it is so and not otherwise.

t, connective, continuative, definite ; a copula, and.

y, euphonic.

ą, ǫ, į, nasals, objectives and copulas.

In order that these modifications may be more perfectly understood, some further explanations of the most important of them are added.

§ 15. **h** predicative, or affirmative. The verb of existence, to be, does not occur in Choctaw, and this particle supplies its place. It is suffixed to nouns, pronouns, infinitives, adjectives, adverbs, prepositions, conjunctions, and article-pronouns, which end in a vowel, to form a proposition ;

when they end in a consonant, the consonant receives an accent called the substantive verb accent. Examples:

vlla, a child.	vllah, it is a child.
vno, I.	vnoh, it is I.
takchi, to tie.	takchih, he ties.
kvllo, strong.	kvlloh, he is strong.
fehna, very.	fehnah, it is very.
anụkaka, within.	anụkakah, it is within.
minti, come.	mintih, it is come.
mihma, and.	mihmah, and it is.
a, the.	ah, it is the.
o, a, one.	oh, it is a, it is one.
he, will, shall.	heh, it will be, it shall be.
hatak, man.	hatak′, it is a man.
chukvsh, heart.	chukvsh′, it is the heart.
tuk, tok, was, has en.	tuk′, tok′, it was, it has been.

This particle is not subject to any change for person, number, or gender. Its place is at the end of a proposition. In such expressions as kullo fehnah, he is very strong, the h is removed from kulloh, he is strong, to the end of the sentence. When used with a verb and article-pronoun, it is in printing often prefixed to the latter, instead of being suffixed to the former, where it properly belongs; as, achi hokeh, for achih okeh, he there says.

§ 16. **k** determinate. This particle limits with precision the word to which it is joined,—just that much, no more, no less, and no other. Like h, it is a suffix, although it is often written as a prefix of the following word. Thus, ilvppvt achukma kvt yummak o i shahli hokeh, this in goodness is better than that, should be ilvppvt achukmak vt yummak o i shahlih oke. The particle k is also used as a prefix to a vowel in the past and future tenses of verbs in the negative forms, where it has reference to the verb, in order to limit it in this form; as, ik kvllo ke tuk, which should be written, ik kvllok etuk. In renewed mention in remote past time, k is changed to ch, as chash, chamo, for kash, kamo; and in some instances h and k are interchangeable, as nachi yim mikvt or nachi yim mihvt, thy faith.

§ 17. **m** successive, simultaneous, compellative. This is a prefix, never a suffix, of **a**. It may be translated after nouns by, the also, the too; and after verbs by when, then, when then, then when. Examples: iyi ma, the feet too; vmoshi mvto, as for my uncle, he too; aki mvno, as for my father, him also. As a compellative it is prefixed to ah; miko mah, a king. It is prefixed to ak to make a definite expression that something is just now gone before, or will next follow, or is now passing; as, ia lih mak okeh, I am going now.

§ 18. The form **shkeh.** The absolute article-pronoun termination shkeh is definite, and follows verbs, adjectives, and adverbs in the present and future tenses, and the pronouns sia, chia, I, thou, etc.

ia lish keh, I go, absolutely, present tense, I am going, I am off.

ia lash keh, I shall go, I will go, let me go, let me off.

The distinctive form is seen in ia li hok eh, I go instead of doing something else; ia lish, I go, and k that, eh, it is; ia la chi shk eh, go I will and that it is; ia lashke, indefinite and remote future for ia la heshke.

§ 19. The conditional forms **km** definite, and **okm** distinctive.

The definite conditional is formed from k determinate and suffix of a word, and m a successive and prefix of a, kma. Luke XII. 53; ia lih, I go; ia lik, a determinate act; ia lik ma, when I go then.

The distinctive conditional is made by the pronoun o before k in okm; ia li hokma, if I go, suppose I go; km and okm take the definite **a** with its modifications.

§ 20. The optative forms **kb** definite and **okb** distinctive. These particles form the optative mood, by prefixing the infinitive of the verb.

§ 21. Y is used as a prefix to **a** and **o**. It is euphonic after the vowels a, i, o, and before a and o; vlla yvt, vlla yosh, ushi yvt, in place of vlla vt vlla osh, vshi vt.

§ 22. The definite article-pronoun of comparison or contrast. This is used to specify objects either as inferior or superior to others when placed in contrast, corresponding to the phrases "how much more," "how much less," especially with definite and pointed emphasis. The simple form is het in the nominative, and hi in the oblique case. But these are not in use. The compound forms only are used.

Nom. case, ak het, mak het, okak het.
Oblique case, ak hi, mak hi, okak hi.

Contradistinctive form.

Nom. case, ak heto, mak heto, okak heto.
Oblique case, ak heno, mak heno, okak heno.

Conditional form.

Nom. case,	k mak het	Oblique case,	k mak hi
	ok mak het		ok mak hi
	k mak heto		k mak heno
	ok mak heto.		ok mak heno.

Examples of the use of these pronouns where a contrast is expressed may be found in John III. 20, hokakheto, Mat. XXIII. 26, yokakheto, 1 John V. 9, 2 Cor. III. 8, 9, Luke X. 35, John VIII. 4.

§ 22. GENERAL TABLE OF DECLENSIONS OF THE ARTICLE-PRONOUNS.

The definite:
Nom. case, at, vt, et, it.
Oblique case, a, i, i.
The distinctive:
Nom. case, osh, ot, ocha.
Oblique case, o, o, ona.
The contradistinctive:
Nom. case, ato, vto, eto, heto, anto, atoha.
Oblique case, ano, vno, eno, heno, ano, anoha.
Or in one table:
Nom. case, at, vt, et, it, het; osh, ot, ocha; ato, vto, eto, heto; anto, atoha.
Oblique case, a, a, i, i, hi; o, o, ona; ano, vno, eno, heno; ano, anoha.

§ 24. TRANSLATION OF THE ARTICLE-PRONOUNS, AND THEIR MODIFICATIONS.

a definite. When **a** immediately follows a noun it may generally be translated by the article, or else omitted. When any verb is understood in connection with a noun, **a** should be translated by a relative pronoun; as, Atvm ak osh hatak moma i̱ tikba hatok, Adam he was of all men the first of them he was; Adam the one who of all men was the first. When a modifying word or words follow the noun, the particle comes last; as, miko vt mintih, the king comes; miko a̱ pisah, the king he sees (regem videt); miko chito vt mintih, the great king comes; miko chito a̱ pisah, he sees the great king. The particle follows pronouns and designates their cases, vno vt, I; vno a̱, me.

§ 25. **o** distinctive. When it follows nouns it denotes them as unknown; nvni chaha yo, a mountain; the particular mountain is not known, but it is made a distinctive object, a mountain and not a plain, or other place. The difference between **a** and **o** may be seen in Mat. XVII. 1, and 9, nvnih chaha yo, a mountain; nvnih chaha ya, the mountain. It has an emphatic and prominent meaning in such sentences as Gal. IV. 2, Pal sia hosh, I, Paul; Acts VIII. 20, Chihowa yosh nan ima ya̱, the gift of God; Acts V. 4, hatak o̱, men. Like **a**, it is rendered by the personal pronouns in both cases and numbers, he, she, it, they, him, her, it, them, and by the relative and double pronouns. It has a contradistinctive sense in such expressions as Mat. XXV. 3, bila yano, as for the oil, in distinction from the lamps. It is used after verbs, and with some conjunctions, to render a distinct reason for an action; as, Luke XI. 37, ont chukowa cha, impa chi̱ hosh binili tok, he came in and sat down for to eat. It has a concessive sense when combined with the particles ok ak; as, yohmic hokak o, although it is so.

Sometimes the article-pronouns are used to translate the articles a and the, and sometimes they are used in Choctaw where the articles do not occur in English. Some examples from Mark I. will illustrate this. The beginning, vmmonak vt; the gospel, vbanumpa; the son of Jehovah, Chihowa ushi; the way, ataya ya̱; the river of Jordan, Chatan okhina yako̱; John, Chanvt; Jordan, Chatan ako; Jesus, Chisvs vt; a girdle, vskofvchi yo̱; water, oka yo̱; the water, oka ya̱; a voice, anumpa hvt; the angels, enchel vhleha hosh; the sea, ok hota; the ship, peni ash; fishers of men, hatak hokli yo̱; the unclean spirit, shilombish okpulo ash osh; the unclean spirits, shilombish okpulo hak.

Matth. XV. 38: Mihma okla impa tuk vt, ohoyo vlla aiena hokvto a̱sha ho̱, hatak 4000 ushta tok; And they that did eat were 4000 men, beside women and children. Here vt makes those who ate definite, while ho̱ makes the women and children distinctive and objective.

Acts IX. 6. nanta hak o̱ katiohmi la hi a̱? What wilt thou have me do? is definite; but, Acts XXII. 10: nanta ko̱ katiohmi la chi̱ ho? is distinctive.

§ 26. TABLE OF TRANSLATIONS OF THE ARTICLE-PRONOUNS.

1. Nominative case, as articles;

1. Definite, at vt, et, it, a, the.
2. Distinctive, osh, ot, ocha. a, an, the one.

2. Nom. case, as personal pronouns;

1. Definite, at, vt, et, it, he, she, it, they.
2. Distinctive, osh, ot, ocha, he, she, it, they.

3. Nom. case, as relative pronouns;

Definite, at, vt, et, it, who, which, what, that.

4. Nom. case, as double pronouns;

1. Definite, at, vt, et, it, he who, she who, that which, they who.
2. Distinctive, osh, ot, ocha, the one who, some who, the ones who, any one, some one, some who.

5. Renewed mention;

1. Definite, ash, the, the said, the aforesaid.
2. Distinctive, ok, ak, osh, the one, any one who.

6. Contradistinctive;

1. Distinctive, compound, ato, vto, eto, he as for, she as for, it as for, they as for (he as for him, etc).
2. Definite compound, okvto, they which, such as they. See Luke VII. 25, XII. 4.

7. Definite distinctives;

ak osh, he the one who, she the one who, it the one which, they the ones who, they who and not others.

8. Distinctive definite;

ok vt, he, she, it, they particularly.

9. Renewed mention distinctive;

ash, osh, the said he, the said she, the said they. Luke VII. 20, hatak ash ot.

10. Conditional;

1. Definite, kmvt, if the, when the, if he, if she.
2. Distinctive, okmvt, if it were he then, etc.
3. Contradistinctive, okmvto, if then as for him, etc.

11. Oblique case, as articles;

1. Definite, a̲, i̲, a, an, the.
2. Distinctive, o̲, ona, a, the, any, some.

12. Oblique case, as personal pronouns;

1. Definite, a̲, i̲, him, her, it, them.
2. Distinctive, o̲, ona, him, her, it, them.

13. Relative pronouns;

Definite, a̲, i̲, whom, which, what.

14. Double pronouns;

1. Definite, a̲, i̲, him whom, her whom, those whom.
2. Distinctive, o̲, ona, the one whom.

15. Renewed mention;

ash, the said. Luke VII. 19, Chan ash ot.

16. Definite and distinctive;

ok ak o, the one whom, any one whom.

17. Contradistinctives;

ano, vno, eno, as for him, her, it, them.

kvno, mvno, okvno.

18. Definite distinctive;

ak o, the one whom, he whom, those whom and not others. ak ok, Luke VIII. 12.

19. Distinctive definite;

aka, him, her, them.

20. Renewed mention distinctive;

ash o, the said.

21. Conditional;

1. Definite, kma, if him, if her, if it, if them. Luke XII. 53.
2. Distinctive, okma, if so.
1. Definite, kmvno, if him, etc., what then.
2. Distinctive, okmvno, if so what then.

21. Comparative forms;

1. Nom. ak het, particularly he, she, it, you, I, or they.
2. Oblique, ak hi, particularly him, her, it, you, me, or them.

22. Predicative form;

1. Definite, ah, eh, he is, she is, it is, they are.
2. Distinctive, oh.
1. Definite and final, shkeh, it is.
2. Distinctive and final, okeh, it is so and in no other way.

23. Ancient and sonorous forms;

ocha, hocha, yocha.	ona, hona, yona.
katoha.	kanoha.
okakanto.	okakano.
okakocha.	akakona.

These were formerly used by the orators at the public assemblies, but are now almost obsolete.[1]

The compound forms often admit of both the articles, the pronouns, and the relatives, in their translation; alam okash, he the one who; nukhaklo vkleha yokvto, the last word being composed of y euphonic, o distinctive, k demonstrative, a definite (varied to v), t connective, and o final, and is in form a contra-distinctive, "the merciful, they who are so, as for them, they."

§ 27. Position of the article-pronouns. The article and personal pronouns generally follow nouns and their attributes. The relatives follow pronouns, verbs and their attributes; vno vt, I who, ia li tuk vt, I who went I, Svso ilvppvt illi tuk osh, falamvt okchaya hoke, Luke XV. 24.

[1] In former times there was a well known solemn style which abounded in sonorous words. One part of a sentence was nicely balanced by another, and in delivery a chanting or metrical intonation was used. At the close of each paragraph the orator would invite the people to listen, who would in turn indicate approval by crying out yvmmah! It is that! (or "that's so"); and viphesa! It is right! The most frequent peculiarity of the style was the lengthened pronominal suffixes, as for instance, Nanta hocha? What is it? Nana hona, something. (*Byington* MSS).

The article-pronouns are moveable, and may be transferred from the logical to the grammatical subject, in order that they may retain their character as suffixes.

In the tenses, the article-pronouns may either precede the particle by which the tense is indicated, as, a tok, etok, itok, achi, or follow it, as, a-tuk a, a tok a̲, a chik a̲, a tuk o̲, a tok o̲ (literally, a, he; tok, past tense particle, did; o̲, it; he did it); anta la chi̲ hatuk oke, Luke XIX. 5, I must abide; hlvpi sabvnnah a tuk, salt I wanted it was, it was salt that I wanted, h predicative, a a relative pronoun.

§ 28. Change of case. A peculiarity in the use of the article-pronoun with nouns is that the nominative case changes to the oblique case when another subject is introduced. For example, Matthew XIII. 4, Atuk osh hokchi ma na nihi kanimi kvt hina lapalika yo̲ kaha tok; atuk o̲ hushi puta kvt ant vpvt tahli tok. Here osh, nom. he (the sower), is changed to ma, oblique, before na nihi kanimi kvt, another subject (some of the seed); and this latter nominative becomes atuk o̲, oblique, before the next subject, hushi puta kvt, (the fowls).

§ 29. USE OF THE ARTICLE-PRONOUN WITH NOUNS.

In connection with nouns, the article-pronouns indicate case, and may thus be regarded as forming a sort of declension. For example:

hatak, man, men.

Nom. case.	Oblique case.
hatak okvt, the man, as a man.	hatak amo, the said, the same man.
hatak okvto, the man, as for the man.	hatak oka, as a man, a man.
hatak okmvto, when the men they.	hatak okvno, the men they.
hatak ash osh, men the said.	hatak okmvno, if men then.

peni, a boat, boats.

peni vt, the boat, a boat.
peni o, a boat, some boat.
peni mvt, the boat also, a boat too, or also.
peni vto, peni anto, as for the boat, contradistinctive.
peni mvto, as for the boat, also, then.
peni amo, the said boat.
peni osh, a boat, one boat, the boats, some boats.
peni a tuk, peni ya tok, the boat which was.
peni a chi, the boat which will be.
peni a hinla, the boat which can be.

Example: Luke XVII. 32, Lat tekchi a tok a̲ hvsh ithaiyanashke, she who was the wife of Lot, her remember.

§ 30. TABULAR LIST OF ARTICLE-PRONOUNS.[1]

Definite forms.		Distinctive forms.	
Subjective.	Objective.	Subjective.	Objective.
at, vt, et, it, ish	a̲, i̲	osh	o
vto, ato	ano, vno	okvt	oka̲

[1] *Subjective and Objective.*—These expressions are used by Mr. Byington rather in their logical than their grammatical sense, and must be so understood in this Table. The list here given is evidently not complete, but it is accurately copied from his latest revision.

Definite forms.		Distinctive forms.	
Subjective.	Objective.	Subjective.	Objective.
mvt	ma	okmvt	okma
mvto	mvno	okbat	okbeh
	ak, mak,	okbato	okbano
kmvt	kma	omo	omo
kmvto.	kmak		
kbat	kba		
cha	na		
amo	amo		
lish	lį		

Neither subjective nor objective.

h	ok
eh	ok ak
akok	okm
mak	okmak
km	okvmo, okamo
	ochosh.

Finals, or verb substantive forms.

h, eh, shkeh	hokeh
ah	oh

CHAPTER II.

PRONOUNS.

§ 1. The pronouns are divided into two classes, separable and inseparable. Separable pronouns are independent words. Inseparable pronouns are fragmentary words, and are all prefixed to other words, except li, I, which is suffixed.

I. SEPARABLE PRONOUNS.

§ 2. These are of four classes, 1, distinctive personal; 2, definite personal; 3, possessive; 4, personal-and-possessive.

1. The distinctive, or emphatic personal.

Simple form.	With h predicative.
vno, I, me, mine.	vnoh, it is I, it is mine.
chishno, thou, thee, thine.	chishnoh, it is thou, thine.
pishno, we, us, our (def).	pishnoh, it is we, ours.
hvppishno, we, us, our (dis).	hvpishnoh, it is we, ours.
hvchishno, you, yours.	hvchishnoh, it is you, yours.

§ 3. These pronouns are used in the nominative, oblique, and possessive cases for all genders, without change of form. Their case is shown by the article-pronouns, which they take for specification, emphasis, and case.

They are prominent, generally standing at the beginning of a sentence without an antecedent, and are repeated by the inseparable pronouns which follow in the same clause or sentence. They are nasalized with some of the article-pronouns; as, vno vto, vnonto, as for me; vno ak osh, I the one who, but vnąk osh, I being the one who.

Note.—The first person plural has two forms. The first is the definite or exclusive plural, and does not include all who are present, but only a fixed number. The second is the distinctive or inclusive plural, and embraces the speaker and all who are present, but ignores all others. All personal and possessive pronouns have this double plural.[1]

2. The definite Personal.

Simple form.	With h predicative.
sia, I, me.	siah, I am.
chia, thou, thee.	chiah, thou art.
pia, we, (def.) us.	piah, we are.
hvpia, we, (dis.) us.	hvpiah, we are.
hvchia, you.	hvchiah, you are.

These pronouns generally have an antecedent, either a noun, or the distinctive personal pronoun, or both. They may be in the nominative or oblique case, which is denoted by the article-pronoun which follows them.

§ 4. The personal pronouns in the third person, singular and plural, are wanting. They are supplied by a gesture, or by other pronouns; as, ilvppa, this; yvmma, that; ilap, he, she, it, his, her, its; mih, he, she, it, they, the same, the said; okla, people. When no pronoun is expressed, the third person is understood.

§ 5. Examples of the use of the definite and distinctive personal pronouns: Acts X. 26, vno ak kia hatak sia akinli hoke, *I* am also a man; Mat. XIV. 27, vno ash sia hoke, it is *I;* Luke XVIII. 13, nan ashvchi sia hoka, for I am a sinner; Exodus XX. 2, vno ak osh Chin Chitokaka Chihowah sia hosh Echip yakni a——chi kokchi li tuk oke, I am the Lord thy God which have brought the out of the land of Egypt, vno I distinctive, sia I definite.

[1] I have here retained Mr. Byington's definition, but I have no doubt the Choctaw double plural is similar to that of other American tongues. The first plural, definite or exclusive, excludes the second person; the second, distinctive or inclusive plural, includes the second person, and may or may not, include the third person. Thus the Indians in speaking to the whites, would say pishno, we (excluding the hearers), but to those of their own nation, hvpishno (including the hearers). The terms exclusive and inclusive to designate this distinction were, I think, first introduced by Father Holguin, in his *Grammatica y Arte Nveva de la Lengva Qquichua* (Ciudad de los Reyes, 1607), and he calls attention to the fact that when used with verbs, the distinction refers to the action of the verb: "mas no se toma con verbos, por razon del pronombre, como aqui [where the pronouns are independent], sino por la significacion del verbo, si es en todos o no ygual, o si se excluyen de la accion del verbo, o de su significacion, aquellos con quien se habla" (fol. 12 recto). In the *Grammar of the Dakota Language* p. 9, the Rev. Mr. Riggs defines the inclusive as a dual (*I and thou*), the correctness of which I doubt, as it may also mean *I and you*, or *We and you*. Equally erroneous is Mr. Du Ponceau's comparison of the exclusive plural with *nous autres*, in French (*Langues Sauvages de l'Amerique du Nord*, p. 155), because *nous autres* does not necessarily exclude the hearers.

6. The possessive.

Simple form.	With h predicative.
vmmi, mine.	vmmih, it is mine.
chimmi, thine.	chimmih. it is thine.
immi, his, hers.	immih, it is his, hers.
pimḷni, ours (def).	pimmih, it is ours.
hvpimmi, ours (dis).	hvpimmih, it is ours.
hvchimmi, yours.	hvchimmih, it is yours.
immi, theirs.	immih, it is theirs.

The reciprocal forms of this pronoun are: ittimmi, each other's; ittimmih, they are each other's, singular and plural.

§ 7. Personal-and-possessive pronouns.

Simple form.		With h predicative.	
Definite, ilap,	he, she, it, and	ilapah	it is his, hers, its, theirs, etc.
ilapa	his, hers, its, his own,	ilapah	
Distinctive, ilapo	they, theirs, their own.	ilapoh	

The first and second persons are formed by prefixing inseparable personal pronouns; thus:

salap, I myself, me myself.
chilap, thou thyself, thee thyself.
pilap, we, us, ourselves (def).
hvpilap, we, us, ourselves (dis).
hvchilap, you yourselves.

And to these again the inseparable possessive pronouns may be suffixed; thus:

Def. ilapi, ilapim, ilapin, his own, her own, their own.
Dis. ilapoi, ilapoim, ilapoin, his own, etc.

Examples: Mark I. 34, ilapa okla ithana hatuk o, because they knew *him;* Mat. X. 32, vno ak kia ilapa, I also *him;* John XIII. 3, ilap ak o ibbak u, his hands.

§ 8. The separable pronouns are the same for all genders, as are also all other pronouns, nouns, and verbs. They take the article-pronouns for the purpose of specification, emphasis and case. They can all take the intensive pronoun inli, self; *e. g.:* vno inli, I myself too; sia hak inli, ilap ak inli, etc.

II INSEPARABLE PRONOUNS.

§ 9. These are of seven classes, 1, subjective-personal, 2, objective-personal, 3, objective-possessive, 4, reflexive, 5, reciprocal personal, 6, reciprocral possessive, 7, the marriage or sacred pronoun. They are always prefixed (except li, I,) to the words with which they are in concord, and are never used alone.

§ 10 The subjective-personal.

Affirmative form.	Negative form.
li (a suffix,) I.	ak, I not.
ish, is, thou.	chik, thou not.

Affirmative form.	Negative form.
e, il, we (def).	ik, he, she, it not.
eho, iloh, we (dis).	ke, kil, we not.
hvsh, hvs, you.	heloh, kiloh, we not.
	hvchik, you not.
	ik, they not.

E and eho stand before consonants, il and iloh before vowels. The third persons are wanting in the affirmative form. Li is the only one of the subjective personals that takes the article-pronouns.

§ 11. These pronouns are used in the nominative case with transitive, intransitive, neuter, and passive verbs. When used with neuter and passive verbs they imply an active state, signification, being, or condition. Examples:

Transitive verbs,	tackchi, to tie.
	takchih, he ties it (h predicative).
	takchihlh, I tie it.
	ish takchih, thou tiest it.
Intransitive verbs,	nowa, to walk.
	nowa lih, I walk.
Neuter verbs,	nusi, to sleep.
	nuse lih, I sleep.
Passive verbs,	holitopa, to be honored.
	holitopalih, I get honor.

When these pronouns are used with neuter and passive verbs, the subject of the proposition is active.

These pronouns are rendered as possessives by changing the verbs to nouns; as, apehlichi, to rule there; apelichi lih, I rule there; apelichi li, my kingdom; ish apelichi, thy kingdom; it aiashvchi, our sins; itti bapishi li Sal mah, my brother Saul (from itti bapishi, to suck the breast together).

§ 12. The objective personal.

Affirmative form.	Negative form.
s, sa, sv, sai, si, I, me, my.	iks, ik sa, ik sv, ik sai, ik so, not me.
chi, ch, thou, thee, thy.	ik chi, ik ch, not thee.
wanting	ik, not him, not her.
pi, p, we, us our (def).	ik pi, ik p, not us.
hvpi, hvp, we us our (dis).	ik hvpi, ik hvp, not us.
hvchi, hvch, you, your.	ik hvchi, ik hvch, not you.
wanting	ik, not them.

§ 13. These forms are used where by the pronoun no action is implied. They are not in the nominative case, although in common conversation they are thus translated. They should be treated as in the oblique case. They are used as subjective, objective, or possessive pronouns, and are prefixed to transitive, passive, and neuter verbs, to those nouns which pertain to one's person, to the various members, and to near family relatives. Examples:

Transitive verbs:	chi pesah, he sees thee.
	hvchi hakloh, he hears you.

Passive verbs: chi tallakchih, bound thee it is.
Neuter verbs: chi abekah, thee sick be.
chi achukmah, thee good be.
sa yonhah, me fever be.
Names of members, and relatives: sa nushkoboh, my head, me head, it is.
sa chụkvsh′, it is my heart.
svsoh, it is my son.
satekchih, it is my wife.
svpvfv, my dog, it is my family dog.
sabaiyih, it is my nephew.
subbitek′, it is my niece.

The h predicative, or its accent ′, will be observed at the end of these sentences.

§ 14. The objective possessive.

Affirmative form.

a, am, vm, vmi, an, sa, sam, sum, sumi, san, my, of me, to me, for me, from me, &c.
chị, chim, chimi, chin, of thee, etc.
ị, im, imi, in, of him, her, it.
pị, pim, pimi, pin, of our (def).
hvpị, hvpim, hvpimi, hvpin, of our (dis).
hvchi, hvchim, hvchimi, hvchin, of your.
i, im, imi, in. of their.

Negative form.

ik sa, iksam, iksvm, ik san, not of me, not to me, not for me.
ik chị, ikchim, ikchin, not of the, etc.
ik ị, ik im, ikin, not of him, her, it, etc.
ik pị, ikpim, ikpin, not of us.
ik hvpị, ikhvpim, ikhvpin, not of us.
ik hochị, ikhvchim, ikhvchin, not of you.
ik ị, ikim, ikin, not of them.

§ 15. This class of pronouns is used where there is an acquisition and possession, but not an implied ownership as a part of the thing spoken of.[1] Thus; a̱ shapo, my hat (French, *chapeau*); vmissuba, my horse; an chuka, my house, are things acquired and possessed; but sanushkobo, my head; svbbak, my hand; are integral parts of my person. A few nouns relating to the person take the possessive pronouns; as, vmiskonata foni, my collar-bone; vm uksak foni, my ankle bone.

§ 16. These pronouns are prefixed to nouns and verbs, transitive, intransitive, passive, and neuter. Before nouns they may be translated, of him, of her, in the singular, and of them in the plural; as, Chan in chuka, John of him house, John's house; Chan micha Chemis in chuka, John and James's house, or houses, for them, of them, etc.

Before transitive and intransitive verbs they may be rendered by to, for,

[1] An analogous difference occurs in construction in the Algonkin dialects: "Les êtrês qui tiennent leur manière d'être du Créateur, prennent la marque du possessif. Les êtres qui tiennent leur manière d'être de l'homme ne le prennent pas." *Etudes Philologiques sur quelques Langues Sauvages de l'Amerique*, p. 44.

from, or of him, of her, of them; as, in chumpah, he buys for or from him, her, or them; i kanchih, he sells to him, or for him, or them; im ia lih, I go for him, imonah, she goes to him; pim vlah, he comes to us, or for us.

Before passive and neuter verbs they may be translated by of him, for him, to him; or, by I, thou, he. Examples:

Passive verbs, intvllakchih, she is bound for him.
i boa, it is beaten for him.
im patafah, it is plowed for him.

Neuter verbs, i kulloh, he is hard to him.
im achukmah, he, she, it is good to him.
im puttah, they are all for him, all his.
in tonlah, it lies for him.
im ashah, they sit for him.
im ahobah, it seems to him.

§ 17. The reflexive.

This is ille, ill, he himself, she herself, etc. It is used where the subject and object are the same. Example:

ille takchi, to tie himself or herself.

Affirmative forms.

ille takchih lih,	I tie myself.
ish ille takchih,	thou tiest thyself.
ille takchih,	he ties himself, she, it, etc.
il ille takchih,	we tie ourselves (def).
iloh ille takchih,	we tie ourselves (dis).
hvsh ille takchih,	you tie yourselves.
ille takchih,	they tie themselves.

Negative forms.

ak ille takchoh,	I do not tie myself.
chik ille takchoh,	thou dost not tie thyself.
ik ille takchoh,	he, she, does not tie himself, herself.
kil ille takchoh, / kiloh ille takchoh,	we do not tie ourselves.
hvchik ille takchoh,	you do not tie yourselves.
ik ille takchoh,	they do not tie themselves.

§ 18. The reciprocal-personal.

This is itti, itt; the former before a consonant, the latter before a vowel. They are used where the subject and object both being either in the nominative or oblique case mutually act on each other; as, itti takchih, to tie each other together. Examples:

itti takchilih,	I tie him together with me.
ish itti takchih,	thou tiest him together with thyself.
itti takchih,	he, she, it, they tie each other together.
il itti takchih,	we tie each other together, (def).
iloh itti takchih,	(dis).
hvsh itti takchih,	you tie each other together.
itti halvllih,	they pull each other.

§ 19. Reciprocal possessive.

This is itti, ittim, ittin, of, to, for, from each other; as, itti halvlli, they pull from or against each other. Both these and the preceding class, unite with the subjective personal inseparable pronouns.

§ 20. The marriage or sacred pronoun.

This is ho before consonants, oh before vowels. It is used in the first, second, and third persons singular, and the second and third persons plural, as a substitute for son-in-law, father-in-law, mother-in-law, their brothers, sisters, and cousins. It has no variation to express number, case, or gender. It is limited in use to the persons whose relationship is created by marriage; except the husband and wife. It is going out of use, as well as the ancient usages about marriage, especially that which required the mother-in-law and son-in-law to avoid each other. The use of this pronoun may be compared to the emphatic *he* or *she*, with which the master or mistress of the house is sometimes referred to in English; as, when *he* comes back, meaning father, or husband. The father says to his son-in-law, vmissuba ik hopeso, has he not seen my horse? oh ia lih, I went with him; ho mintilih, I come with him, or her; oh ant ik sapeso ka hinlah? will he not come to see me?

§ 21. Combinations of the six classes of inseparable pronouns with the verb pisa, or pesa, to see.

1. The subjective and objective personal.

Affirmative form.		Negative form.
chi pesa lih,	I see thee,	ak chi pesoh,
pisa lih,	I see him, her, or it,	ak pesoh,
hvchi pesa lih,	I see you,	ak hvchi pesoh,
pisa lih,	I see them,	ak pesoh,
issa pesah,	thou seest me,	chik sa pesoh,
ish pisah,	thou seest him, her, it,	chik pesoh,
ish pi pesah,	thou seest us,	chik pi pesoh,
ish pisah,	thou seest them,	chik pesoh;
sa pesah,	he sees me,	ik sa pesoh,
chi pesah,	he sees thee,	ik chi pesoh,
pisah,	he sees him, her, it,	ik pesoh,
pi pesah,	he sees us,	ik pi pesoh,
hvchi pesah,	he or she sees thee,	ik hvchi pesoh,
pisah,	he or she sees them,	ik pesoh,
e chi pesah,	we see thee,	ke chi peso,
e pisah,	we see him, her, it,	ke pesoh,
eho pisah,	we see ourselves (dis.),	ke ho pesoh,
e hvchi pesah,	we see you,	ke hvchi pesoh,
e hohvchi pisah,	we (all present) see you,	ke hohvchi pesoh,
e pisah,	we see them,	ke pesoh,
hvs sa pesah,	ye see me,	hvchik sa pesoh,
hvsh pisah,	ye see him, her, it,	hvchik pesoh,
hvsh pi pesah,	ye see us,	hvchik pi pesoh,

Affirmative form.		Negative form.
hvsh pisah,	ye see them,	hvchik pesoh,
sa pesah,	they see me,	ik sa pesoh,
chi pesah,	they see thee,	ik chi pesoh,
pisah,	they see him, her, it,	ik pesoh,
pi pesah,	they see us,	ik pi pesoh,
hvchi pesah,	they see you,	ik hvchi pesoh,
pisah,	they see them,	ik pesoh.

2. Subjective personal and reflexive.

Affirmative.		Negative.
ille pis alib,	I see myself,	ak ille pesoh,
ish ille pisah,	thou seest thyself,	chik ille pesoh,
ille pisah,	he, etc., sees himself,	ik ille pesoh,
il ille pisah,	we see ourselves (def.),	kil ille pesoh,
eloh ille pisah,	we see ourselves (dis.),	kiloh, ille pesoh,
hvsh ille pisah,	you see yourselves,	hvck ille pesoh,
ille pisah,	they see themselves,	ik ille pesoh.

Ille occasionally takes a locative and drops e; as, illahobachi, to make like to himself.

3. Subjective, objective, and reciprocal-personal.

Affirmative.		Negative.
chitti pesa lih,	I see thee and thou seest me,	ak chitti pesoh,
itti pesa lih,	I see him and he sees me,	ak itti pesoh,
hvsh itti pesa lih,	I see you and you see me,	ak hvchitti pesoh,
itti pesa lih,	I see them, etc.,	ak itti pesoh,
is svtti pesah,	thou seest me and I see thee,	chik svtti pesoh,
ish itti pesah,	thou seest him and he sees thee,	chik itti pesoh,
ish pitti pesah,	thou seest us and we see thee,	chik pitti pesoh,
ish itti pesah,	thou seest them and they see thee,	chik itti pesoh,
svtti pesah,	he sees me and I see him,	ik svtti pesoh,
chitti pesah,	he sees thee and thou seest him,	ik chitti pesoh,
itti pesah,	he sees him, her, and she, he, sees him,	ik itti pesoh,
pitti pesah,	he sees us and we see him,	ik pitti pesoh,
hvchitti pesah,	he sees you and you see him,	ik hvchitti pesoh,
itti pesah,	he sees them and they see him,	ik itti pesoh,
e chitti pesah,	we see thee and thou seest us,	ke chitti pesoh,
il itti pesah,	we see him and he sees us,	kil itti pesoh,
iloh itti pesah,	we see one another,	kiloh itti pesoh,
e hvchitti pesah,	we see you and you see us,	ke hvchitti pesoh,
il itti pesah,	we see them and they see us,	kil itti pesoh,
hvs sitti pesah,	you see me and I see you,	hvchik svtti pesoh,
hvsh itti pesah,	you see him and he sees you,	hvchik itti pesoh,
hvsh pitti pesah,	you see us and we see you,	hvchik pitti pesoh,
hvsh itti pesah,	you see them and they see you,	hvchik itti pesoh,
svtti pesah,	they see me and I see them,	ik svtti pesoh,

Affirmative.		Negative.
chitti pesah,	they see thee and thou seest them,	ik chitti pesoh,
itti pesah,	they see him and he sees them,	ik itti pesoh,
pitti pesah,	they see us and we see them,	ik pitti pesoh,
hvchitti pesah,	they see you and ye see them,	hvchik itti pesoh,
itti pesah,	they see one another,	ik itti pesoh.

4. The possessive-objective, in combination with the subjective-personal and objective personal.

Affirmative.		Negative.
chį pisa lih,	I see for thee, of thine, &c.,	ak chį pesoh lih,
į pisa lih,	I see for him, her,	ak į pesoh lih,
hvchį pisa lih,	I see for you,	akhvchį pesoh lih,
į pisa lih,	I see for them,	akį pesoh lih,
is są pisah,	thou seest for me, of mine,	chik są pesoh,
ishį pisah,	for him,	chik į pesoh,
ish pį pisah,	for us,	chik pį pesoh,
ish į pisah,	for than,	chik į pesoh,
ą pisah,	he sees for me, or of mine,	ik są pesoh,
chį pisah,	for thee,	ik chį pesoh,
į pisah,	for him,	ik į pesoh,
pį pisah,	for us,	ik pį pesoh,
hvchį pisah,	for you,	hvchįk pesoh,
į pisah,	for them,	ik į pesoh,
e chi pisah,	we see for thee, of thine,	ke chį pesoh,
il i pisah,	him,	kil į pesoh,
iloh i pisah,	ourselves,	kiloh į pesoh,
e hvchi pisah,	ourselves,	ke hvchį pesoh,
eho hvchi pisah,	you,	ke hohvchį pesoh,
il i pisah,	them,	kil į pesoh,
hvs są pisah,	you see for me, of mine,	hvchik są pesoh,
hvshi į pisah,	him,	hvchik į pesoh,
hvshpį pisah,	us,	hvchik pį pesoh,
hvsh į pisah,	them,	hvchik į pesoh.

The third plural, is the same as the third singular.

The possessive is sometimes found before the reflexives ille and ill, and sometimes after them; as, im ill anoli, to confess oneself to him; illį nutakvchi, to humble oneself before him; im ille haiakvchi lih, I shew myself to him.

Combinations with the reciprocal pronouns are formed in the following manners:

chittį pisa lih,	I see for you (or of yours)with you.
ittį pisa lih,	him, her, them.
hvchittį pisa lih,	you, etc.
svttį pisah,	he sees for me together with me.
echittį pisah,	we see for thee together with thee.
hvs sitti pisah,	you see for me together with me, etc.

When two possessives are prefixed to a verb, one is subjective and one objective; as,

vm į nukhąkloh,	he pities him for me.
chim į nukhąkloh,	thee.
im į nukhąkloh,	him, her, or them.
pim į nukhąkloh,	us.
hvpim į nukhąkloh,	us.
hvchim į nukhąkloh,	you.

The negative is ik sum į, ik chim į, ik im į, etc.

The following form is a combination of the subjective personal, possessive, and reciprocal possessive:

ish im ittį nukhąkloh,	you have pity on each other for him.
il im ittį nukhąkloh,	we have pity on each other for him.
hvsh im ittį nukhąkloh,	" " "

§ 22. Relative pronouns. The article-pronouns supply the place of the relative pronouns, which are not found in Choctaw. This use of the article-pronouns will be seen in the following examples:

Nom. case.		Oblique case.	
Alvm vt,	Adam he who,	Alvm ą,	Adam him, whom.
If vt,	Eve she, who,	If ą,	Eve her, whom.
lukfi vt,	clay it,	lukfi ą,	clay it.
Alvm ak osh,	Adam, he who,	Alvm akǫ,	Adam, him whom.
If ak osh,	Eve, she who,	If ak ǫ,	Eve, her whom.

§ 23. Interrogative and responsive pronouns. The interrogative pronouns kvta, nanta, katima, who?, which?, what?, have two forms, one for interrogation, the other for response. They both take the article-pronouns, like the other separable pronouns, to indicate case. Examples:

interrog. kvta hosh ik bi? Who made it? (osh or hosh is the subjective or nominative suffix).
respons. kvna hosh ik bi tuk. Some one made it.
interrog. nanta hosh minti? What is coming?
respons. nana hosh mintih. Something is coming.
interrog. katimak osh achukma? Which of them is good?
respons. kanima kia achukmah. Any one of them is good.
interrog. katimampo hosh ia chį hǫ? Which (of the two) will go?
respons. kanimampo hosh ia hinlah. Either of them will go.
interrog. katima hosh bvnna? Which of them (all) want it?
respons. kanimik vt bvnnah. Several of them want it.

Oblique case. kvta ho ish pisą tuk ǫ? Whom did you see?
nanta ho chibunnah? What do you want?
katimak ǫ ish chumpa tuk ǫ? Which did you buy?

A definite interrogative ends in an aspirate, as, chi bvnnah? Do you want it? A distinctive interrogative ends in a nasal, as, chi bunną? These pronouns may also be subjective, as, nanta hosh yohma wah, nothing could do it; nanta hakosh yohma wa, no one could do it.

§ 24. Demonstrative pronouns. These are used to supply the want of a personal pronoun in the third person singular and plural. They are:

ilvppa, this, these, he, she, it, they (near).
yvmma, that, those, he, she, it, they (remote).

Their plural is sometimes formed by adding the word putta, all. They take the article-pronouns, and are declined by it. Examples: Gen. XIV. 20, yvmmak ak, who; Gen. IV. 2, yvmmak okvt, which; Luke XVI. 27, yvmmak oka, him; Luke XVI. 28, yvmmak mvt, they also; 29, yvmmak o, them.

§ 25. There are other words used as pronouns, some if not all of which can be also used as verbs and adjectives. They are:

chvfa, one, a certain one, the one, the other.
achofona, any.
achvfaiyuka, each one.
achafoa, some, a few.
aiyuka, each, every.
bika, each, same, both, fellow, Mark IX. 33.
inla, other, another.
inli, self, itself.
itatuklo, both, two together.
luna, many.
kanimona, some, several, from kanimi to amount to, and ona some.
kanimusi, a few.
mih, he, she, it, the same, the identical one, they.
mika, each.
moma, all.
okla, a people, they; used to form the plural of nouns.
oklha, all, the entire crowd, number, or quantity.
puta, all, each and every one; used to form the plural of nouns.
vhleha, all collectively, of persons only.

DECLENSION OF THE PERSONAL PRONOUNS.

1st personal singular.

Nom., I,	sia; vno; li.
Oblique, me,	s, sa, sv, sai, si; vno.
Possessive, mine,	sa, sam, svm, svmi, san; vmmi; vno.

1st person plural.

	Definite form.	Distinctive form.
Nom., we,	pia; pishno; e, il.	hipia; hvpishno; eho, iloh.
Oblique, us,	pi, p; pishno.	hvpi, hvp; hvpishno.
Poss., our, ours,	pi, pim, pimi, pin; pimmi.	hvpi, hvpim, hvpimi, hvpin; hvpimmi.

2nd person singular.

Nom., thou,	chia; chishno.
Oblique, thee,	chi, ch; chishno.
Poss., thy, thine,	chi, chim, chimi, chin; chimmi.

	2nd person plural.
Nom., you,	hvchia; hvchishno.
Oblique, you,	hvch, hvchi; hvchishno.
Possessive, your, yours,	hvchi, hvchim, hvchimi, hvchin; hvchimmi.

CHAPTER III.

VERBS.

§ 1. There are six classes of verbs in Choctaw, the transitive, intransitive, passive, possessive, attributive, and personal.

§ 2. The passive verb is made by an internal change of the transitive; but this rarely takes place except in verbs where the transitive effects a visible change in the object acted on. Thus, takchi, to tie; tvllakchi, to be tied; sa tvllakchi, I am bound; but pisa, to see; sa pisa, he sees me, not I am seen. The passive is formed so variously that rules are not attempted. The following examples will illustrate this: hofahli, to abash, passive, hofahya; okpvni, to abuse, pas. okpvlo; atokoli, to aim, pas. atokoa; atokoli, to appoint, pas. ulhtoka; okchali, to awake, pas. okcha, siteli, to bind, pas. sita; hopi, to bury, pas. hollohpi; akvlli, to cobble, pas. ulhvta; ikbi, to build, toba, to be built; hukmi, to burn, holukmi, to be burned; chanli, to chop, chạya, to be chopped; bohli, to beat, boa, to be beaten; bvshli, to carve, bvsha, to be carved. Some passives are made by prefixing lh, a locative and intensive particle from vhli, it may be, to the active; as, tohno, to hire, ilhotno, to be hired; ipeta, to feed, ilhpita, to be fed; apoa, to give in marriage, passive, vlhpoba; abeha, to enter a place, passive, vlhbiha.

§ 3. The possessive verb is formed by prefixing the inseparable possessive pronouns to other verbs. Thus, ihikiah, he has him standing; imantah, he has him staying; intalaiah, he has it standing (like water in a vessel); imachukmah, he has good, there is good for him; intobah, he has it made; imokpuloh, he has evil, he is evil.

§ 4. The attributive verbs affirm attributes or qualities, and are often used as adjectives and adverbs; as, kullo, to be strong; sa kulloh, I am strong; achukma, to be good; sa achukmah, I am good. The possessive pronouns are affixed to these verbs, as vm achukmah, I have a good one; ạ falaiah, I have a long one, or it is long for me.

§ 5. The personal verbs take the objective inseparable pronouns; as, sa lakshah, I perspire; svllih, I die; sanusih, I sleep; saiokchayah, I live; sa hoitah, I vomit. When the act is involuntary, sometimes a change in the form of the verb occurs; as, hoeta lih, I vomit it up; hotilhko lih, I cough; habishko lih, I sneeze; fiopa lih, I breathe.

§ 6. All verbs end in the infinitive in i, a, or o. They all have an affirmative and negative form in all moods and tenses. This is made by

means of the negative prefix ik, and by changing the terminal vowel to o when it is i or a; when it is o, it undergoes no change. Thus, anta, to stay; ik anto, not to stay; minti, to come; ik minto, not to come; ik ishko, not to drink.

Both forms take the inseparable pronouns as prefixes, and the article-pronouns as suffixes, but both classes of pronouns are written separately, as far as may be. Thus, chi pisa lik vt, thee see I who, I who see thee.

§ 7. The modes. There are six modes, the infinitive, indicative, potential, subjunctive, optative, and imperative.

§ 8. THE INFINITIVE MODE.

This is the root or ground form of the verb, from which the other modes are formed by suffixes. It can be used as a noun, or in an adverbial sense, takchi, to tie, a tier, the act of tying; hvllot takchi, to tie strongly. It takes the inseparable pronouns and the prepositions as prefixes, and the article-pronouns, and particles of tense as suffixes. Examples: chi takchi, to tie thee; chin takchi, to tie for thee; ille takchi, to tie himself; itti takchi, to tie each other; itį takchi, to tie them to each other; a takchi, to tie at; on takchi, to tie on; isht takchi, to tie with; ant takchi, to come and tie; ont takchi, to go and tie; et takchi, to tie hither; pit takchi, to tie thither; takchi ą, to tie him to the; takchi ma, to tie simultaneously; takchi hǫ, to tie distinctive; takchi tuk, takchi tok, to have tied; takcha chį, takcha he, to tie in the future; takcha chin tuk, to be about to have tied; takchi tuk achį, to have been about to tie.

The English infinitive is sometimes translated by the indicative: as Mat. V. 17, okpvni la hi osh ąya li tuk keyu; amba aiąhlichilą he mak a tok, I am not come to destroy but to fulfil; sometimes the English indicative is translated by the infinitive; as Mat. XI. 30, vm ikonla abana yą il abanali ka im vlhpiesa, to put on himself my yoke is easy for him.

The negative form is made by the prefix ik, and the change of the last vowel to o, and corresponds to the English prefixes dis, un, in, etc.; as, iktakcho, not to tie, to untie; haklo, to hear, ikhaklo, not to hear.

§ 9. Modifications of the verb. There are numerous modifications of the ground form or infinitive mode of verbs, each of which forms a new infinitive from which other modifications may arise. Some of the modifications are by internal changes, others by adding a particle. They are:

1. The definite form, takchi, to tie.

2. The distinctive form, tąkchi, to be tying the while; implying continuance, prominence, and comparison.

3. The intensive form. This is made in various ways:

1. By an increase of emphasis on the accented syllable of a word; as, tókbah, to be *so* bad; tákchi to *tie*.

2. By lengthening the vowel sound in the accented syllable; as, chito, to be large, cheto, to be quite large; patvssa, to be flat, patassa, to be quite flat.

3. By inserting a syllable; as, taiyakchi, to tie; chieto, to be decidedly large.

4. By prefixing the diphthong ai to words beginning with a vowel; as, ahli, to be true, aiahli, to be really true; sometimes i is prefixed, as iiksho, to be none indeed.

5. By prefixing **a** to words beginning with a consonant; as bilia, to be forever, abilia, to be forevermore.

6. By doubling a consonant in the accented syllable; as, alota, to be full; allota, to be brimful; kvnia, to be gone, kvnnia, to be gone off.

7. By inserting a consonant in the final syllable; as, chukva, to go in, chukowa, to go in boldly; i̱hoa, to call him, i̱ howa.

8. By prefixing ai and inserting another vowel; as, ulhpisa to be right, aiulhpiesa, to be just right.

9. By uniting two verbs; as, ishkottahli, to drink all up; vbitkanchi, to massacre.

4. The frequentative or iterative form; tahą̇kchi, to keep tying.

5. The instantaneous or quick form, by the insertion of h in the accented syllable; as, tahkchi, to tie quickly; vbi, to kill; ahbi, to kill quickly; also the form ahahbi; kvnia, to go away, hvninihya, to vanish.

6. The form for a sudden and single act; as shalvlli, to slide, shalakli, to slip; halvlli, to hold, halakli, to catch hold of.

7. The diminitive form in neuter and attributive verbs; as, chito, to be large, chihto, to be largish; hopaki, to be far off, hopahki, to be rather far off; lakna, to be yellow, lahakna, to be yellowish.

8. The repetitive form, to continue an action in one place and one manner; as, binili, to sit, binininli, to rise up and sit down again; tonoli, to roll, tonononli, to roll back and forth.

9. The causal forms, 1, by suffixing chi; as, takchichi, to make him tie; ikbichi, to make him do or make, Mat. V. 32; 2, by suffixing chechi; as, ishko, to drink, ishkochechi, to make to drink, to drench; 3, by suffixing chi and prefixing a, locative; as, atakchichi, to tie it to something; 4, by suffixing li; as, achukmali, to make good; lvshpali, to make hot, to heat. Of these suffixes, chi denotes the causing of the action signified by the primitive verb; as, kvllochi, to harden, from kvllo, to be hard; kolichi, to cause to break, from koli, to break; chechi suffixed to a verb denotes the causing by its own subject of the performance of the action signified by the verb by another subject on an object expressed or understood; as, vno vt vlla yą̇ ikhi̱sh ą̇ ishkochechi li tuk, I the child him the medicine it did cause him to drink; nafoka yą̇ fohkvchechi lih, I made him put his clothes on himself; chi with a, locative, signifies that two different things are acted upon together, as Mat. XIII. 25, onush ash haiyu̱kpulo yo̱ ant a hokchichi cha, kvnia tok, he came and sowed tares among the wheat, not wheat with wheat but tares with wheat; aka̱kushi yo̱ shuka nipi ą̇ aiauvshlichih, she fries (causes to fry) eggs with pork.

The suffix kachi, kechi, kvchi, is added to many verbs slightly altering their sense; as, winali, to shake, winakvchi, to be shaken; basasua, to have stripes, bassasu̱ kvchi, to be striped like a rattlesnake; malvtha, to lighten,

malvthakvchi, to flash once; bichota, to bend, bichotakvchi, to bend and spring once.

Note.—Verbs may have all the above forms, but the number of verbs found in all these forms are small.

Example, takchi, to tie, infinitives.

Active:

Definite	takchi, to tie.
Distinctive	tąkchi, to be tying.
Intensive	taiyakchi, to tie firmly.
Frequentative	tahąkchi, to keep tying.
Speedy	tahkchi, to tie instantly.

Passive:

Definite	tvllakchi, to be tied.
Distinctive	tąllakchi, to be the one being tied.
Intensive	talaiyakchi, to be tied fast, or at length.
Frequentative	talaiyahąkchi, to be often tied.
Speedy	talahkchi, to be instantly tied.

§ 10. INDICATIVE MODE.

This is formed from the infinitive by prefixing and suffixing the personal pronouns, and suffixing the tense particles for past and future time.

1. Present tense, indefinite, with subjective personal pronouns.

takchih,	he, she, or it ties, or they tie, him, her, it, or them.
ish takchih,	thou tiest him, her, it, or them.
takchi lih.	I tie, etc.
hvsh takchih,	ye tie, etc.
e takchih,	we tie, etc. (def).
eho takchih,	we tie, etc. (dis).

2. Pres. tense, definite, with subj. pers. pronouns.

takchishkeh, third sing. and pl.

To this the pronouns are added as in the indefinite.

3. Pres. tense, distinctive, with subj. pers. pronouns.

takchih okeh, third sing. and pl.

To this the pronouns are added as above.

4. Pres. tense, with objective pers. pronouns.

chi takchi lih,	I tie thee.
takchi lih,	I tie him, her, it, or them.
hvchi takchi lih,	I tie you.

5. Pres. tense, with possessive pronouns.

in takchi lih,	I tie for him, her, it, them.
chin takchi lih,	I tie for thee.
hvchin takchi lih,	I tie for you.
in takchih,	he ties for him, her, it, them.
chin takchih,	" for thee.
an takchih,	" for me.
hvchin takchih,	" for you.
pin takchih,	" for us.
hvpin takchi,	" for us.

Past tenses. There are two past tenses, signified by the particles tuk and tok; tuk is used for the immediate and definite past, tok for the remote and indefinite past. They may be combined to form the relative or pluperfect past; as, tuk a tuk, tuk a tok, tok a tuk. The particle **a** in these expressions is an article-pronoun, and should be rendered thus: he, she, it was.

Past tense definite.

takchi tuk,	he, she, it, they tied, did tie, have tied.
ish takchi tuk,	thou "
takchi li tuk,	I.
hvsh takche tuk,	you.
e takche tuk,	we.
eho takche tuk,	we, etc.

Past tense distinctive.

This is formed by the article-pronoun, okeh.

takchi tuk okeh, he, etc., tied, did tie, has tied.

Another form of the past tense is made by a nasal sound in the fina vowel, as, takchi̱, cham̨o.

Future tense.

There are two forms of the future, made by the addition of chi̱ for the immediate, and he, or hi, for the remote and indefinite future. The distinctive future is made by suffixing okeh to chi̱ and he; as, chi̱ okeh, hi okeh.

The suffix ashkeh is used for the definite, absolute, or imperative future.

The past and future are combined to form a relative future; as, tuk a chi̱, tuk a he, tuk ashke, was to tie; also chin tuk, chin tok, he tuk, hitok, will have, shall have, would have, should have.

§ 11. POTENTIAL MODE.

This is formed from the infinitive by suffixing the articles hinla, may, can, and pulla, must, will.

Present tense (but with reference to future time).

Indefinite	takcha hinlah,	he, etc., may or can tie.
Definite	takcha hinlvshhe,	he, etc., may or can tie.
Distinctive	takcha hinla hokeh,	he, etc., may or can tie.
Indefinite	takchi pullah,	he, etc., must or will tie.
Definite	takchi pullvschkeh,	he, etc., must or will tie.
Distinctive	takchi pulla hokeh,	he, etc., must or will tie.

The past tenses are formed like those in the indicative mode, the tense signs being suffixed to hinla and pulla; as, takchi la hinla tuk, I may or might have tied.

§ 12. SUBJUNCTIVE MODE.

This is formed from the infinitive by suffixing km for the definite and okm for the distinctive. The m takes the definite article-pronoun **a** in all its forms.

Note.—km, if, when, whether, is compounded of k, a suffix, definitive of the idea contained in the verb; as, takchik, he ties, at that, in that, or

just that; and of m, simultaneous or successive, affirming or supposing something in relation to the idea limited or bounded by k, then, when, at the same time or place; takchi km, when he ties then.

This suffix can be added to the other modes in all their tenses; as, infinitive, takchi kma, if to tie him, when to tie him; indicative, takchi kmah, if or when he ties him; potential, takcha hinla kmah, if he can tie him.

Present tense.

takchikmvt,	definite subjective,	if he, etc., tie, then he.
takchikmah,	definite objective,	"
takchihokmvt,	distinctive subjective,	"
takchihokmah,	distinctive objective,	"

The past and future tenses are inflected with the personal pronouns as in the indicative, except the forms which end in eh. These are always final, and admit of no suffix nor inflections.

In the past tenses, tuk and tok, the k in kmvt, kmah, etc., is dropped. that in the tense particle taking its place. In the remote future, he, the distinctive form is not he okmah, but hokmah.

The distinctive form okm expresses a condition or supposition with more emphasis, and implies a greater degree of uncertainty than km; as, infinitive, takchi hokma, to tie him, if so; indicative, takchi li hokmah, I tie him, if so it be; takchi la hinla hokmah, I tie him if it can be so.

Examples: Romans XII. 20, chin tvnvp vt hohchvfo hokma; if thine enemy hunger; John XVI. 7, vno vt ia li keyu hokmvno, if I go not away; same verse, amba ia li hokmvto, but if I do go away; Mat. IX. 12, amba abeka yok mak oh chatuk oke, but they (distinctive) who are sick; Luke XVI. 30, im ona hokmvno, if one went unto them, then; Mat. XI. 15, haksobish vt i hinlikmvt, if he have ears, definite; John XIX. 12, ish i hotofi hokmv, if thou lettest him go, distinctive; Phillip II. 1, a̱sha hokma, if there be, a suppositive form; I. Cor. XIII. 8, nan ithana yokmá, whether there be knowledge, a suspensive form.

§ 13. OPTATIVE MODE.

This is formed from the infinitive by suffixing kb definite and okb distinctive. The particle b takes the article-pronoun **a** in its definite and contradistinctive forms, babato, babano, and **o** distinctive and emphatic as a prefix, in distinctives and contradistinctives.

takchikbat,	definite subjective,	oh! that he, etc., would tie it, then he.
takchikba̱h,	definite objective,	"
takchikbato,	contradistinctive subjective,	"
takchikbano,	contradistinctive objective,	"
takchihokbat,	distinctive subjective,	oh! that he, etc., would tie, even he, then he.
takchihokbah,	distinctive objective,	"
takchihokbato,	contradistinctive subjective,	"
takchihokbano,	contradistinctive objective,	"

Examples:

Subjective form: shukbo chumpak bato, oh! that he would buy a blanket, (and take it home and wear it, etc).

Objective form: shukbo chumpak bano, oh! that he would buy a blanket, (then others might buy).

Contradistinctive subjective:

shukbo chumpa hokbato, oh! that he would *buy* a blanket, (instead of borrowing one), and do something else, wear it, etc.

Contradistinctive objective:

shukbo chumpa hokbano, oh! that he would *buy* a blanket, then others would come and buy, or do something else.

Luke XIX. 42, nana isht chi ai yukpa he ai ulhpiesa ka ish ithaiyna tokokbato, if thou hadst known, or, oh! that thou hadst known; even thou, then thou, etc. Iali hokbat, I wish I could go and I (do something); iali hokbah, I wish I could go and he (do something).

The persons, tenses, and numbers correspond with those in the indicative mode.

§ 14. IMPERATIVE MODE.

Affirmative:

ik takchih,	let him, her, it, or them tie.
takchih,	tie thou.
ak takchih,	let me tie.
hvsh takchih,	ye tie, tie ye (def).
ho takchi,	ye tie, tie ye (dis).
ohiah,	go ye (dis).
ke takchi,	let us tie (def).
keho takchi,	let us tie (dis).
kiliah,	let us go (def).
kilohiah,	let us go (dis).
takchashkeh,	let him, her, or them tie.

The particle ashkeh is suffixed to the infinitive in the last word to express an imperative in the shape of a wish.

The imperative negative is formed by changing the terminal vowel of the verb into o, and suffixing the particle kia; or particles of negation may be used, such as na, wa, heto, he, keyu.

Examples:

ik takcho kiah,	do not let him tie.
ish takchi nah,	don't you tie him.
ish takcha wah,	you will not tie him.
ish takcha heto,	you shall not tie him.
ish takcho he keyu,	you shall not tie him.

Double negatives may be used, not, not no; as:

ak tąkcho ki nah;
ak takcho ka wah;
ak tokcha ka he keyuh.

Compare Luke VII. 39, ik akostinincho ka heto, he would not have not known, *i. e.*, he would have known.

§ 15. IRREGULAR VERBS.

The irregular verbs are: vbi, to kill; vmo, to trim, to mow; vla, to arrive; vpa, to eat; ia, to go. The vowel v in these verbs is dropped in a part of the persons in both numbers; thus:

Affirmative form.

vpah,	he, etc., eats, *i. e.*, of one article of food.	vbih, he kills.
ishpah,	thou eatest.	ish bih, thou killest.
vpalih,	I eat.	ube lih, I kill.
hvshpah,	you eat.	hvsh bih, you kill.
epah,	we eat (def).	ebih, we kill.
iloh vpah,	we eat (dis).	iloh vbih, we kill.

Negative form.

ik poh,	he does not eat.		ik boh.
chik poh,	thou		chik boh.
ak poh,	I		ak boh
hvchik poh,	you		hvchik boh.
ke poh,	we	(def).	ke boh.
kiloh poh,	we	(dis).	kiloh aboh.

In the frequentative form of these verbs, the pronouns in the second person singular and plural are modified thus: ahanla, ihishla, sing., ahashlah, pl.

ia, to go.

Affirmative form.		Negative form.
iah,	he goes,	ik aiyuh.
ish iah,	thou goest,	chik aiyuh.
ialih,	I go,	ak aiyuh.
hvsh iah,	you go,	hvchik aiyuh.
il iah,	we go,	kil aiyuh.
iloh ia,	we go,	kiloh aiyuh.

iksho, to be none, may be a negative form of vsha or ąsha.

It is conjugated:

ikshoh,	he is not, there is none.
ikchikshoh,	thou art not.
iksakshoh,	I am not, etc.

and:

ik im ikshoh,	he has not, there is none for him, etc.

Keyu, not to be, has no modifications except h predicative, and the causatives chi and kechi; as, keyuchi, to make it nothing; keyukechi, keyukma, if not, or. Kia, although, is perhaps an imperative form of ia, to go, ikiah, let him or it go. It has no variation except to take h predicative, kiah, although it be.

§ 16. It will be seen that verbs have usually but one form for both singular and plural numbers. Some verbs, however, have a plural, made by an internal change; as, hikah, it flies; helih, they fly; binilih, he sits; binohli,

they sit; talahlih, he sets it up; talohlih, he sets them up; kopoli, to bite, plural, kobli; kanchi, to sell, plural, kampila; bohli, to lay down, plural, kapulli; tifi, to pluck up. plural, tehli; malleli, to run, plural, yihlepa. Some verbs have this plural form only; as, ilhkolih, they move off; pehlichi, he rules them; chiyah, they sit. Some have the singular number only; as, issoh, he strikes once.

Some few verbs are dual; as, tihlaiah, they two run; ittonachih, they two go there together.

The inseparable pronouns determine the number of the verb in the first and second persons. The third person singular and plural has no personal pronoun; okla is sometimes used as a singular, dual, and plural pronoun; as, anumpulit okla tok, they two spake.

Note.—By a verb in the plural is meant plurality either in the subject or object; as, wak pelichih, he or they drive cattle, and wak a̱ chuffichi, they drive a cow. Here pelichih is in the plural number, and chuffichi in the singular.

CHAPTER IV.

PREPOSITIONS.

§ 1. There are few words in Choctaw that correspond to the English prepositions. The article-pronouns to some extent supply this want. Some verbs involve a preposition in their meaning; as, ona, to go to; vba, to arrive at; bokyupi, to bathe in the creek; hu̱sa, to fire at. The inseparable possessive pronouns i̱, im, in, involve a preposition, to him, for him, of him, from him, against him; so also do the reciprocal possessives, itti, ittim, ittin, to each other, for each other, etc.

The preposition, to, in the infinitive is contained in the simple form of the verb; takchi, to tie. The preposition of, showing the genitive or possessive case is understood; iti hishi, leaf of a tree. When one of the nouns expresses ownership in the other, the inseparable possessive pronoun is used; as, vlla i̱ holisso, the child its book.

§ 2. As the Choctaw is deficient in single words expressing space and time, it uses in place of them prepositive particles of definite significations. These are:

1. Locatives.

They are: a, before consonants; ai, before vowels, and before y. This means the place for, in which, at which, from which, to which, where, there, then; as, afoha, to rest at or in a place, a time for resting; aminti, to come from; ahikia, to stand in; aianta, to stay at or in; ai impa, to eat at or there; ai-illi, to die in a (room, etc.), or at (noon, night, etc.); aianuk filli, to think of; aiahni, to long for; ayukfa, to rejoice at.

o, om, on. This is a more definite locative than a, ai, and may be translated by on or upon; as, onbinili, to sit on; ontalali, to ride on; oyihlepa, to rush upon; ontalali, to set on or upon.

2. Distinctives:

Et, anet, here, hither, to this place; et is the simple form, anet the intensive; et is from the verb echi, to reach, hand, or hold this way, to pass in this direction, intensive form anechi. These particles are transitive verbs, and are connected by the letter t with other verbs. Echi has the form of a causative verb, ishtishko a echih, pass the cup hither. Examples: et kanchi, to cast it this way; et anoli, to report hither; et anuk filli, to think this way; awethikia, to stand this way, toward the speaker.

Pit, thither. This is a subjective directive (made so by the t). It is from the verb pila, to send off, or throw, from the speaker to some other point. Examples: pit kanchi, to throw that way; pitanoli, to report it thither; pit anukfilli, to think of thither; pit hikia, to stand or lean that way.

3. Instrumental:

Isht, with. This is derived from the verb ishi, to take, with t distinctive and continuative. Its literal meaning is often lost in the many uses it has as a prefix. Examples: ishtabeka, to be sick with; ishtanowa, to walk with; ishtan umpuli, to talk of; ishtanuk filli, to think about; ishtholitopa, to take it and be rich.

4. Of motion.

Ant, from avvt, means motion hither, to a place; as, ant anta, to come and stay.

Ont, from onvt, means motion thither to a place; as, ont anta, to go and stay.

5. Social.

Iba, with, in company with, awaya, to go with, awant, to bring with. Examples: ibatoksvli, to work with; ibapisa, to see with, a school-mate; itanowa, to travel together, a fellow-traveler; awantanta, to stay with; awantia to go with, awaya, to marry, fem. *i. e.*, she married him; itawaya, he marries her, or they marry.

6. The war or fire particle:

This is ito, before a consonant; it, before a vowel. This particle implies mutuality of action between the fire and what is put on it, or between those who kindle fires in a hostile manner against each other. Examples: oti, to kindle a fire; itoti, to fire each other; itotaya, to wage war by fires. It is used in the New Testament, Mat. VII. 50, tvli a bila luak chito ka pit ito—ashacha he, to cast them into the furnace of fire. This particle ito may help us to understand how wars were formerly waged by fire rather than by weapons, these being very imperfect in construction, while fire was always at hand.

§ 3. These particles have various combinations with each other; as, aio, aiom, ai on, ont ai, ant ai, ont isht, ant isht, isht o, etc., but as they are written separately, they can be readily understood. Examples: ont ai isht ia, go and of it take and go; isht im ai achukma hokeh, they take and in them have pleasure, it is so; ishtai o holissochi, to write on it therewith.

CHAPTER V.

NOUNS.

§ 1. In Choctaw there is no grammatical difference between common and proper, animate and inanimate, concrete and abstract nouns. They have no internal changes nor inflections to denote number, gender, or case. These accidents are supplied by additional words, or are left unexpressed.

§ 2. NUMBER.—Nouns are presumed to be in that number which is most natural to them. If the number is required to be specified, numerals, numeral adjectives, pronouns, or verbs are subjoined. Examples: wak, a cow, cows; wak achofa, one cow; wak tuklo, two cows; wak lawa, many cows; wak moma, all the cows; wak vmmi, my cow or my cows; hatak vt antah, a man stays; hatak vt a̱shah, men are staying; wak vt tihlaiah, the two cows run.

§ 3. GENDER.—A few nouns only have names in the masculine and feminine gender; as, hatak, a man; ohoyo, a woman; nakni, a male; tek, a female. When gender is emphatic, these words, nakni, and tek, are subjoined; as, vlla nakni, a boy; vlla tek, a girl; issinakni, a buck; issi tek, a doe.

§ 4. CASE.—All nouns take article-pronouns for specification, emphasis, and case. The subjective relation of a noun to a verb is indicated by the article-pronouns in the nominative case; the objective relation by the article-pronouns in the oblique case. A noun, however, is often used by itself, without the article-pronoun, and may then be either in the nominative or oblique case, the connective alone deciding which, though usually it is oblique. Examples: hatak vt mintih, man he comes; hatak mintiah, man comes, or men come; hatak vt pisah, a man sees, or men see; hatak a̱ pisah, man him (or men them) he sees.

§ 5. The nominative and oblique independent. This occurs when two nouns or pronouns are in a subjective or objective relation to the same verb. In this case the first is emphatic or independent; as, hatak okvto i̱ nitak vt hvshvk ak o̱ chiyuhmi hokeh, man as for, he for him, days they, grass, that which is, like they are, so it is.

hatak	achvfa	hosh	ushi	vt	in	tuklo	tok,
man	a certain	he	sons	they	to him	two	so it was.

In these sentences, hatak okvto and hatak achvfa hosh, are in the nominative case, and nitak vt and ushi vt, are also in the nominative case. So in the oblique case:

hvchishno ma,	isht hvchi̱,	mihacha he,
you indeed,	you,	it shall not be judged to, or you, you shall not be judged.

§ 6. The possessive or genitive sense.

Possession may be shown by simple position; as, iti hishi, tree leaf, the tree's leaf; hatak kvllo, man strength, the man's strength, a man of

strength; Chahta okla, the Choctaw nation, miko ibbak, king hand, the king's hand.

Where there is an acquired possession, the inseparable possessive pronouns i, im, in, are inserted between two nouns; as, Chan in chuka, John his house. It is probable that the method of indicating possession by position arose from an elision of this pronoun, as this method is most frequent in names of the human body and its members, of near relatives, in nominative and oblique independent nouns, and generally in such as are obviously integral parts of each other, or by nature closely connected. Examples: miko ibbak, the king (his) hand; miko ushe, the king (his) son; iti vni, a tree (its) fruit; iti hakshup, a tree, its bark; wak pishukchi, a cow (her) milk.

Names of time take the possessive pronoun; as, i̱ nitak, his day or days, which might also be regarded as i̱ dative, to him, for him, as in wak i̱ kanchi, he sells a cow to him or for him.

§ 7. The objective (accusative and ablative) sense.

This is made by article-pronouns subjoined to nouns; as, hatak a̱, man him, man whom, man that. In forming the ablative of time, place, cause, the verb, not the noun, takes the preposition; as, hatak vt a̱ hikiah, the man stands in a place; isht ikbih, he makes it with. The vocative can be indicated by the particle mah; as, miko mah, O king.[1]

§ 8. Classes of nouns.

The nouns are either primitive or derived. The former cannot be traced to any root; such are, oka, water; tvli, a stone; hatak, a man; ibbak, the hand; the latter are derived from verbs, adjectives, other nouns, etc.

§ 9. Derived nouns.

The following examples will show the derivation of nouns:

From transitive verbs:

chanli, to chop, chanli, a chopper, the act of chopping.
bvshli, to saw, a sawyer, the act of sawing.

From intransitive verbs:

nowa, to walk, a walk, the act of walking.
pisa, to see, a seer, a sight.

From passive verbs:

talakchi, to be bound, a bundle.
holitopa, to be honored, honor.
kvnia, to be lost, the loss, the act of losing.

[1] In one portion of his manuscript Mr. Byington propounds the following query: "Cannot all Choctaw nouns be treated as verbs? The root may be considered as in the infinitive mood; as, hatak, to be a man; hatak', it is a man; hatak okmvt, if a man." Prof. H. Steinthal, on the contrary, thinks that the peculiar formation of American tongues makes nouns, but no real verbs. He says of the Aztec: "das Mexikanische in seinem Ansatze zur Wortbildung Nomina gebildet hat, aber keine wahrhaften Verba" (*Charakteristik des Sprachbaues*, s. 218). The author of *Etudes philologiques sur quelques Langues Sauvages de l' Amerique*, p. 38, says: "Les noms algonquins ne se déclinent point, ils se conjuguent." Prof. Steinthal, however, is right. The primitive expressions in these languages are concrete, not abstract,—nouns, therefore, not verbs.

From neuter verbs:
kvllo, to be strong, strength.
ahli, to be true, truth.
From verbs with the locative particle a or ai:
achanli, a chopping place.
impa, to eat, aiimpa, a table.
apisa, a looking glass.
abvsha, a saw-pit, from bvsha, to be sawn.
From verbs with the particle isht instrumental:
isht bvsha, a saw.
isht talakchi, a band.
From verbs with the particle na or nanta:
nakanchi, a seller, from kanchi, to sell.
nanithana, a pupil, from ithana, to learn.
From verbs with the definitive particle ka or kakah:
falamaka, the return, from falama, to return.
chukbika, a corner, from chukbi, to be a corner.
lapalika, the side, from lapali, to be the side of.
chitokaka, the Great One, God, from chito, to be great.
From the verb ahpi, to be first in time:
achafahpi, the first one.
ishahpi, the first taken.
tofahpi, to first of summer, the spring.
hushtolahpi, the first of winter, the autumn.
vttahpi, the first-born.
With ushi, a son, to make a diminutive:
bokushi, a brook, lit., son of a creek.
hinushi, a path, from hina, a road.
ibbakushi, the fingers, from ibbak, the hand.
iyushi, the toes, from iyi, the foot.
With vpi, a stalk, stem, trunk of a tree, main channel of a river, etc:
iyvpi, the leg.
bissvpi, a briar, bramble.
hatakvpi humma, a red man, an Indian.
From the union of two nouns:
bila pvla, lamp-oil.
hvpi oka, brine, salt water.
iti hishi, leaf, leaves.
nishkin okchi, tears.
From the union of three nouns:
chukfi hishi shapo, a wool hat, sheep-hair-hat.
wak hakshup shukcha, a saddle-bag, cow-skin-bag.
From a noun and an adjective:
bota tohbi, flour, white-flour.
hvpi champvlli, sugar, salt-sweet.

From two nouns and an adjective:

issuba haksobish falaia, a mule, horse-ears-long.

From a noun and a verb:

iti bvshli, a tree-sawyer.

shapo ikbi, a hat-maker.

shulush ikbi, a shoemaker.

From two words connected by an article-pronoun:

kanchit ąya, a peddler, one that sells and goes.

mvllit kvnia, a runaway, one that runs and is gone.

From two nouns and a verb:

bila pvla ikbi, a lamp maker.

lukfi ampo ikbi, a potter.[1]

Other combinations are also in use.

10. Abstract nouns.

These are usually formed from neuter verbs; as, kvllo, to be strong, strength; achukma, to be good, goodness; ahli (distinctive form of vhli, edge, end, point, limit), to be true, truth.

The translators of the New Testament rarely, however, use these words alone, but combine others with them.

For example:

nayimmi, faith, I. Cor. XIII. 13.

nannihullo, love.

nanisht į hullo, love.

nanithana, knowledge, 2 Pet. 1, 5.

ishtaivlbi, redemption.

isht aholitopa, glory, Mat. VI. 13.

Often circumlocutions are used; as,

nan-isht hvsh il a nanaiya, your peace, lit., the thing by which you have peace in yourselves, Luke X. 6.

The suffix nana or nan gives an intensive signification; as,

nanįhullochi, accursed thing, Joshua VII. 13.

§ 11. Proper nouns, and terms of relationship.

These take the article-pronouns, and are construed like common nouns. Some proper nouns are simple, others compound. Chahta, Mvskoki, Chalaki, Wishashi, Shawvno, are simple, uncompounded names. Bulbancha, the Choctaw name of New Orleans, is compounded of bvlbaha ąsha, where there is bvlbaha, unintelligible talking in different languages, as in Babel of old.

Apalachicola,	apelvchi okla,	helping people, allies.
Pensacola,	pąshokla,	hairy people.
Pascagoula,	pvskokla,	bread people.
Tombigbee,	itomikbi,	box makers.
Bok humma,		Red river.

Boktuklo, river two, applied to a creek the channel of which is divided by an island.

[1] A number of words have been adopted from the English, and a few from French and Spanish. They all suffer some change. Thus, katus, a cat; shapo, chapeau; wak, vaca (Sp.); enchil, angel.

The terms of relationship are numerous, and differ materially in application from those used in the English tongue; as will be seen in the following list:

I. Kinship by blood.

1. In the male line.

vmafo, my grandfather, the father of my father or of my mother, their fathers, brothers, and male cousins.

aki, my father, his brothers, his male cousins, his uncles and nephews, their brothers and male cousins.

vmoshi, my maternal uncle, his brothers and male cousins.

akni, the eldest among brothers, and male cousins.

ushi, a son, *svso*, my son, son of the father, father's brothers, male cousins, son of the mother, her sisters and female cousins, son of the father's sister (said by this father's son).

sabaiyi, my nephew, a son of my sister or her female cousin.

sapok nakni, my male grandchild, my sister's male grandchildren, my brother's children (said by an aunt).

ittibapishi, brother, literally those who suck together, a general name for brothers and male cousins.

vmmvnni, my elder brother or cousin.

sa nak fish, my younger brother or cousin.

i *nak fi*, her brother, spoken by a woman.

2. In the female line.

vppokni, my grandmother, her sisters, female cousins and their mothers.

hvshke, my mother, her sisters, and female cousins.

ahukni, my aunt, her sisters and female cousins.

akni, the eldest child among sisters and female cousins.

vshetik, or *svsotek*, my daughter, the daughter of my sisters or female cousins, the child of my father's sister, her sister or her cousin.

sapoktek, my granddaughter, my sister's grandchildren, the female child of a brother's sister.

itte bapishi, sisters, female cousins, common gender.

vmmvnni, my eldest sister or cousin.

sanak fish, my younger sister or cousin.

antek, my sister or female cousin, said by a man.

II. Kinship by marriage.

hatak, husband, literally, her man.

tekchi, wife, *im ohoyo*, his woman.

svppochi, my father-in-law, said by the man.

svppochi, ohoyo, my mother-in-law, said by the man.

vmvfa, my father-in-law, said by the woman.

vppokni, my mother-in-law, said by the woman.

sayup, my son-in-law.

sapok, my daughter-in-law.

vmalakusi, my brother-in-law, brother of my wife.

vmalak, my brother-in-law, husband of my sister.

vmafo, my uncle, the husband of my aunt.

vmalakusi ohoyo, my sister-in-law, sister of my wife.

saḥaiya, my sister-in-law, wife of my brother, also wife of my uncle, or of my nephew.

uppo, my sister-in-law.

sapok, my sister-in-law.

vshke, the wife of my father's brother.

ḥaloka, a family name for son-in-law, father-in-law, and mother-in-law.

While formerly the kinsmen (*iksa*) and the peoples (*okla*) had specific names, the family had none.[1] The names of individuals were significant of some trait or quality. Some of the masculine names mean Come and kill, Stand and kill, Kill all, Kill and go; some of the feminine names signify Giver, Bringer, She who loops up her hair, Take water and give him. In times of war brave men received titles, such as Red bird, Red knife, Red owl, etc.

The individual name is sacred, and is never used in common conversation; the name of relationship, my brother, my cousin, is used instead. The wife speaks of her husband as *vlla ịki*, the children's father.

The ancient law of marriage was that no man could choose a wife in his own *iksa*. Hence the matter of clan relationship became one of great importance, and upon it the terms of relationship in general were based. In common salutations, the husband addressed his wife's clan as vm okla mah, my people, but his own clan as vm ai okla mah, inserting the locative particle ai, with an emphatic sense.

Parents usually refer to their offspring as vlla, the child, or children.

There are no words, such as great-grand-father, great-grand-son, etc., to express relationship in the same line beyond grandfather and grandson. All ancestors and descendants more remote than these are called indiscriminately by these terms.

§ 12. Termination of nouns.

Nouns may end with the vowels a, i, o, u, and with the consonants f, h, k, l, n, p, s, and sh; fakit, a turkey, the only noun ending in t, is probably a borrowed word. Those which end with a consonant take the article-pronouns which begin with a vowel sound; as, at, vt, osh, ot, ocha, a̱, o̱, ona, or with the euphonic y; as, yvt, yosh, yocha, ya̱.

CHAPTER VI.

ADJECTIVES.

§ 1. The words used as adjectives, or attributes of nouns, are in reality verbs. All the classes of verbs are used to modify nouns, but the attributive neuter verb is that most frequently employed. When subjoined to

[1] The Choctaws were formally divided into two iksa, and three "fires" or districts. The latter were: okla falala, the long people; ahepvt okla, potatoe-eating people; okla hannali, six peoples. The iksa lived promiscuously throughout the nation and their establishment was attributed to sacred authority. This information I owe to Col. P. P. Pitchlynn, a thorough native Choctaw scholar, who has kindly read the proof of Mr. Byington's Grammar with me.

nouns as adjectives, the verbs drop the inseparable and article-pronouns which belong to verbs alone, but continue to be modified by the internal changes of the verb.

§ 2. The adjective follows the noun it qualifies, and the article-pronouns subjoined to nouns are removed and placed after the adjective. Thus, hatak vt mintih, a man is coming; hatak achukma yvt mintih, a good man is coming. The adjective agrees with its noun in number and case.

§ 3. Affirmative and negative forms.

Adjectives are changed from the affirmative to the negative forms as verbs are. Thus, hatak kvllo, a strong man; hatak ikhvllo, a man not strong; ąhli, true; ikahlo, not true. A noun with its adjective may be conjugated like a verb through the modes and tenses in the affirmative and negative forms.

§ 4. Number.

Adjectives have a singular and plural number. The plural is formep from the singular by internal changes, and by the addition of other words. Examples:

Singular.		Plural.
achukma,	good,	hochukma.
chito,	arge,	hochito.
falaia,	long,	hofaloha.
falvsa,	long and slender,	falvspoa.
pvtha,	wide,	hopvtka.
ibakchufanli,	tapering,	ibakchufashli.
ibakhatanli,	bald faced,	ibakhatashli.
ibakpishanli,	round and pointed,	ibakpashashli.
ibaktasanli,	starved in the face,	ibaktasashli.
yushkotoli,	short,	yushkotushli.
yushbonoli,	curly haired,	yushbonushli.
yushtololi,	short,	yushtolushli.
okchvmali,	green,	okchvmashli.

§ 5. Comparison.

The degrees of comparison are much more numerous than in English. They are expressed either by internal changes, or by the addition of other words. Example: achukma, good.

Descending graduation.

achukma ik ono,	not good enough.
achukma ik lawo,	less good.
achukma momakạ ik lawo,	less good than all.
achukma iklawokit taha,	completely less good than all.

Positive degrees.

achukma,	good.
achokma,	goodish.
achuhkma,	good emphatically.

achoyukma, good in an increased degree.
achu̱kma, good distinctly compared with others.
acho̱hu̱kma, good and growing better.

Comparative degree.

achukma i̱ shahli, better.

Superlative degree.

achukma moma i̱ shahli, best.
achukma kvt i̱ shaht tahli, best, he completes it, subjective.
achukma kvt i̱ shaht taha, best, it is completed, objective.

The last two expressions are attempts to translate the English superlative, and are not natural to the language. They are rarely heard.

Diminutives.

iskitini,	small,	iskitvnisi,	smallish.
okpulo,	bad,	okpulosi,	baddish.
kanomi,	few,	kanomusi,	fewish.

Sometimes it is expressed by a kind of lisp; as for ikchito, not large, say iksito.

§ 6. Numerals.

These are all parsed like verbs, but are here called adjectives, in accordance with custom.

Cardinal.	Ordinal.
1. achvfa.	tikba.
2. tuklo.	atukla, or hittukla.
3. tukchina.	atuchina, or hittuchina.
4. ushta.	aiushta, or isht aiushta.
5. tahlapi.	ishttahlapi.
6. hannali.	isht hannali.
7. untuklo.	isht untulo.
8. untuchina.	isht untuchina.
9. chakali.	isht chakali.
19. pokoli.	isht pokoli.
11. auahchvfa.	
12. auahtuklo.	
13. auahtuchina.	
14. auahushta.	
15. auahtahlapi.	
16. auahhannali.	
17. auahuntuklo.	
18. auahuntuchina.	
19. auah chakali.	
20. pokoli tuklo.	
30. pokoli tuchina.	
100. tahlepa achvfa.	
1000. tahlepa sipokni.	

The word auah means with, akucha, out of, over. There are no words for portions less than one half.

CHAPTER VII.

ADVERBS.

§ 1. Adverbs in Choctaw are verbs as well as adverbs. They are either primitive or derived. The former are single words, such as beka, always; bano, only; illa, merely; tokba, very much; ą̇hli, certainly; pulla, surely.

§ 2. Derived adverbs are formed in various ways. When two verbs have a connective between them, the first of them may serve merely to qualify the second and must then be rendered adverbially, though both may be parsed as verbs; as, achukmalit hvsh hoyashke, do ye search diligently, Mat. II. 8.

Adverbs of place are formed from the demonstrative pronouns ilvppa, here; yvmma, there. These take some of the article-pronouns; ilvppakinli, right here; yvmmakinli, right there.

Adverbs of number are derived from the numerals; as, ushta ha, four times; ai ushtaha, at the fourth time.

Adverbs of time past are derived from the definite article-pronoun ash, renewed mention; as, mish ash, day before yesterday; hopakik ash, long since, long ago.

Adverbs modify each other; fehna chohmi, somewhat very; fehna pulla, surely very. The degree of modification is varied after the manner of adjectives, by emphasis, by prolonging the sound of a word, or by inserting a syllable; as, fehna, fiena; cheki, chehki; chiki, chehika.

Diminutives are formed by adding si; as, olatomasi from olatoma, this way, on this side of; bilį̇kasi from bilį̇ka, close by.

§ 3. Interrogatives. These are definite and distinctive. The distinctive calls for a definite answer; katima ish ia hoh cho? where are you going? anchuka ia lih, I am going to my house.

In speaking an interrogative tone is used, and to increase the strength of the interrogation the final syllable ends with a nasal sound; antą̇? is he staying? mintį̇? is he coming? As there is no predicate in such interrogations, the verbal h final is dropped. There is a milder interrogative where the nasal sound is dropped, and the h predicative is suffixed; as, yohmik ah? is it thus? yobatuh ah? could it be? Interrogatives with the nasal are distinctive; without the nasal they are definite.

An interrogative in the negative demands an affirmative reply; as, yvmmak keyu? is it not that?—it is that.

The principal interrogative adverbs are katima? or mvto? where? nanta? what? katiohmi? how? cho? an interrogative particle. Examples:

Katima ishia hą̇?	Where did you go? (definite.)
Katima ishia hǫ̇?	Where did you go? (distinctive.)

§ 4. Adverbs take the article-pronouns, and some inseparable pronouns; as, sa tikba, before me (in place); an tikba, before me (in time). When they follow verbs, the article-pronouns of the verbs are removed, and placed after the adverbs.

§ 5. Examples of Choctaw adverbs.

Yes, yea,	yau, a̲h, i̲, ome.
Nay, not, no,	keyu, ahą̲h, hą̲, heto, awa, (haia, Chikasaw).
Much,	laua, fehna, apakna.
Little,	kanomusi, iskitine, chvbi̲hasi.
Once,	himona, himonaha.
Twice,	hitukla, hituklaha.
Thrice,	hituchina, hituchinaha.
First,	vmmona, tickba.
Secondly,	ont atukla.
Thirdly,	ont atuchina.
Now,	himak, himo.
Then,	yvmma.
To-day,	himak nitak.
To-morrow,	onna.
Yesterday,	pilashash.
Upward,	vba pila, vbema, vba imma.
Downward,	oka pila, akema, ak imma, aket.
Beyond,	mish sha.
Soon,	cheki.
Enough,	vllpesa.
Perhaps,	chishba, yobaka.
Truly,	ą̲hli (from vhli, the limit).
Hither,	anet.
This side of,	ola.
Toward,	pila.
Merely,	peh.

CHAPTER VIII.

CONJUNCTIONS.

§ 1. Conjunctions connect words, sentences, clauses and paragraphs, and commence and close sentences. They are definite and distinctive.

Definite conjunctions usually end with t, vt, or a; as, mihmvt, mihma, and. The distinctives end with osh or o̲; as, mihi osh, mihio̲. Some are both definite and distinctive; as, okvt, oka, where ok, a demonstrative distinctive, is combined with vt and a definite.

§ 2. They take some of the article-pronouns to exhibit the nominative and oblique cases; as, mihmvt, nom. case, and he, mihma, oblique case, and him; mih is used as a personal pronoun in the third person singular. Mihmvt is literally "he then he;" mihma, "he then him;" mihmvt contains the verb of existence (h predicative) and the subjective copula; mihma likewise contains the verb of existence, and solves the subjective copula, and thus it acts on the subject—the subjective copula being solved,

a new subject with its copula takes its place. This conjunction may be translated by any of the personal pronouns in the third person.

§ 3. The conjunction in the nominative case connects two or more subjects to one verb; as, Acts II. 8—11, where mikmvt and micha connect the names of several nations with eho haiyak loshke.

When there is one subject and two or more predicates, the subject is connected with all the predicates; as, Luke XV. 13, where the connective is suffixed to the predicates as a copula.

But when another subject and predicate following the first are connected with it, the conjunction is in the oblique case. This change of case gives notice of the succeeding subject and predicate; as, Mat. I. 2: Eblaham vt Aisaḳ a tobachi tok; atukọ Aisak vt Chekob a tobachi tok; here, atukọ is in the oblique case, and connects the two prepositions, and shows two different subjects. If it were atuk osh instead of atukọ it would make Abraham a subject of the second preposition. The genealogy of the Saviour in Luke III., illustrates the same usage. The conjunction mihma is there used, "and he," the subject of the next verb. This change in the conjunction does not change the subject to the object. It gives notice of another subject, and connects them both by mihma. The copula is *solved*, and the way opened for another subject to take it. Thus, in Luke XVII. 10: achvfa kok osh Falisi okma, achvfa kvto publikan a tok; okma is in the oblique case. These instances exhibit the difference between a conjunction in the nominative and oblique cases.

§ 4. Conjunctions are divided into the following classes:

1. Copulatives; definite subjective, and, then, t, cha, micha, mihmvt, mikmvt, yohmi cha, yumohmi cha, yohmi mvt, yumohmi mvt.
   definite objective, na, mina, mihma, mikma.
   distinctive, mih họ, mih hosh.
2. Distinctives; or, if not, unless, except, but, keyukmvt, keyu hokmvt, amba, ikshokmvt, keyukma.
3. Concessives; although, nevertheless, be it so, admit it. They concede something which has been said. They are kia and amba. The distinctive article-pronouns osh, o, and oh, often precede kia, as akohkia, okako kia.
4. Adversatives; but, yet, notwithstanding, amba, kia; atuk ak ọ, but, Luke XIX. 14.
5. Causals; therefore, for, because, as, so as, okvt, yohmi hosh, yohmi kokvt, yomohmi hosh, yomohmih họh, yomohmi hokah.
6. Illatives; therefore, wherefore, on account of, yomohmi hokvt, yomohmi hokah.
7. Finals; because, for, hokvt, hokah, yohmi hokvt, yohmi hokah.
8. Conditionals; if, lest, when, then, provided, kmvt, kma (def.), okmvt, okma, (dis).

9. Suspensives; whether, whether or, kmá (def.), okmá, (dis.), ish tohbichikmá; ish lusachikmá, whether white or black, Mat. V. 36.

Examples of conjunctions:

Again,	anonti, anowa, himmakma, himakona.
Also,	aiena, itatuklo, mvt, ma, akinli.
Although,	kia, okakọ, okakosh.
And,	cha, na, micha, mina, mihmvt, mihma, mikmvt, mikma.
Because,	hokvt, hoka, hatukosh.
Besides,	aiena, micha, mikmvt, mikma.
But,	amba, kia.
Except,	keyukma, akcho.
Since,	hatukosh, hatukọ.
Therefore,	yvmohmikmvt, yvmohmikạ, yvmohmihokvt.
Unless,	keyukmvt, keyuhokmvt.

CHAPTER IX.

INTERJECTIONS.

§ 1. The Interjections may be divided into two classes, the subjective and the objective.

§ 2. The subjective interjections.

These are produced by a sudden ebullition of feeling and merely manifest the state of the speaker's mind, as akshukeh! oh! on account of pain from water or cold; akshupeh! oh! when the pain is from fire; ulleh! for any severe pain; ikikeh! when in distress of mind or body.

§ 3. The objective interjections.

These are employed to excite the attention of the party addressed; intah!, ok!, okintah!, well! now! used for defiance or banter; yak eh! look here!, yak okeh, thanks to you; yokokeh, in lamentation; omeh! omishkeh! to call attention, Give ear! There are interjections for times of sport, of mourning, of war, victory and defeat. Some are common to both sexes, some used by only one.

§ 4. Interjections chiefly used by men.

Ahạh,	no! stop! take heed!
Pullashkeh,	God forbid!
Auohmeh,	ah indeed!
Hahah,	oh!
Han,	oh! what!
Humpheh,	oh! in anger, defiance, or pain.
Ok,	well! now! as, I dare you!
Okintah,	well, come on, I dare you.
Omeh,	to invite the attention of hearers.
Omishkeh,	the same in more solemn style.
Yakoh! yakih!,	a shout by the warner to the ball-players.

Interjections chiefly used by women.

Aiena,	alas, wo is me.
Aiyenaheh,	alas, wo, uttered at funerals.
Ehwah,	fie ! begone, in reproach or disgust.
Aiheh,	oho ! half in fun and half in earnest.
Wehkah,	quit ! don't !
Kaihoh,	oh ! in fear.

Interjections common to both sexes.

Ok hoh,	no ! no ! quit ! in anger.
Akshukeh,	oh dear ! it hurts me !
Okshupeh,	oh ! it burns !
Ehah,	woe, woe !
Hai,	in disappointment.
Hok,	oh !
Hush,	alas !
Hushha,	alas !
Ikkikeh,	alas ! pity !
Intah,	well, now, come, enough !
Issah,	quit ! be off ! stop !
Mah,	look there now, sign of vocative.
Makhalokah,	"let it be so to him," in contempt.
Mishia,	begone !
Okkvnno,	indeed !
Okokkoh,	oh dear ! alas !

Stated Meeting, April 15, 1870.

Present, ten members.

Mr. Fraley, Vice-President, in the Chair.

Donations were announced from the Acclimatisation Society of Paris; the Editors of Nature; the Commissioners of Emigration of the State of New York; Prof. Röhrig, of the Cornell University; the Essex Institute; Dr. Newberry; the Phila. Acad. Nat. Sciences; Journal of Med. Sciences, and Franklin Institute, and the U. S. Secretary of the Treasury.

Prof. Cope exhibited and described vertebræ and other parts of a new species of *Bottosaurus*, found in the upper beds

of the Cretaceous Green Sand of Burlington Co., N. J., and showed how it differed from *B. Harlani*.

Prof. Hayden exhibited photographs of fossil fishes, from the Green River locality described at the last meeting, and described a new process of picture printing, from which a great improvement in the representations of natural objects may be expected; he also showed sketches of Gelogical sections of the Rocky Mountain rocks.

Dr. Brinton described the peculiar mode adopted by Mr. Charency for interpreting some curious inscriptions newly discovered at Pelenque.

The Society then proceeded to ballot for members, nominations Nos. 651, 652, 654 and 655, being postponed for the present.

When the ballot boxes were examined by the presiding officer, the following persons were declared duly elected members of the Society:

Major R. S. Williamson, U. S. Engineers.
Hon. J. D. Cox, of Washington, D. C.
Prof. Charles H. Hitchcock, of New York City.
Mr. Edmund Quincy, of Dedham, Mass.

And the Society was adjourned.

Stated Meeting, May 6, 1870.

Present, twenty-five members.

Letters accepting membership were received from Mr. J. D. Cox, dated Department of the Interior, Washington, April 26; Mr. Edmund Quincy, dated Dedham, Mass., April 20; and Mr. C. H. Hitchcock, dated Hanover, N. H., April 29, 1870.

Photographs of Prof. F. L. O. Röhrig, Cornell University, Ithaca, N. Y., and Dr. Horn, of Philadelphia, were received for the album.

Letters acknowledging the receipt of Proceedings and announcing transmissions, were read.

Donations for the Library were received from the Royal Academies and Societies at St. Petersburgh, Munich, Göttingen, Copenhagen and Edinburgh; the Society at Marburg; the Geological Society at Berlin; Geographical Society at Paris, and Astronomical Society at London; the Institutes at Salem, Philadelphia, and Baltimore; the New Jersey and Pennsylvania Historical Societies; the State Geologist of New Jersey; Dr. Ruschenberger, Hon. W. D. Kelley, Mr. C. H. Hunt, Genl. Abbott, and the Public School Commissioners in St. Louis.

The death of a late member of the Society, Mr. Franklin Peale, of Philadelphia, on Thursday morning, May 5, aged 74, was announced by Mr. Robert Patterson, who, on motion of Mr. Fraley, was appointed to prepare an obituary notice of the deceased.

The Secretary communicated, as from the author, the second part of a Memoir on the Geological Position, Characters and Equivalencies of the Marshall Group, by Prof. Alex. Winchell, Part I. of which was published in the Proceedings, No. 81.

The Secretary gave the following account of beads from Indian graves on the Susquehanna River, now in the possession of Prof. S. S. Haldeman, of Columbia, Pa.

A bead found in an Indian grave near Bainbridge, Lancaster Co., Pa., in making the Pennsylvania Canal, about the year 1832. The bead is spherical, but made out of a section of a cylinder, or group of four concentric cylinders, the outer one blue, the middle one red, between these a thin one of white, and the fourth also white, forming an innermost thin lining to the red and a coating to the siphuncle or string-hole through the centre. The end section of the three inner cylinders is star-shaped, or, more properly, corrugated very regularly in 13 waves, like a watch pinion of 13 cogs. The white shining through the blue produces a banded appearance of the surface of the bead, the bands being alternately deep blue and light blue. No doubt the blue cylinder was corrugated on the outside surface, also, and then pressed or rolled smooth. The diameter of the bead across the string-

hole is $\frac{5}{128}$ in., and its length $\frac{1}{4}$ inch. Its general appearance can be known from that of the objects figured on Plate, p. 114, Proceedings Amer. Philos. Soc., Dec. 5, 1862, especially Fig. 3.

With this bead others were found, made of segments of blue glass cylinders about $\frac{1}{16}$ inch diameter, and about half an inch long; others of Venetian red color, of the same diameter, but an inch or an inch and a half long. See similar figures in Schoolcraft. Also, a string of very small copper beads, above $\frac{1}{16}$ of an inch large, every way, made of bits of flat copper wire coiled to receive a string.

Dr. Allen presented for publication in the Transactions, a paper "On some of the effects of age as observed in the osseous system," with three plates, which was referred to a committee consisting of Dr. Ruschenberger, Dr. Leidy and Prof. Lesley.

Prof. Cope presented a paper entitled, "Observations on the Fishes of the Tertiary Shales of Green River, Wyoming," collected by Dr. Hayden. (See Proceedings, page 380.)

Dr. Hayden presented for publication three papers, descriptive of certain elaborately drawn and colored sections of rocks exposed in the cuttings of the Union Pacific Railroad. (See Proceedings, about page 419.)

Professor Cope exhibited and discussed a new Dycynodont cranium from the Trias of South Africa, and compared it with some evidently Dycynodont tusks from the Triassic rocks of the Phœnixville tunnel, on the Reading Railroad, thirty miles northwest of Philadelphia, which he exhibited to sustain his remarks. (See Proceedings, about page 418.)

Mr. James returned to the custody of the Society, the MSS. of Pursh's Botanical Journal, loaned to him for publication in 1869; and, with the MSS., presented to the Library of the Society a copy of the published Journal, with MSS. notes of his own interleaved.

Mr. James returned, also, certain mosses, loaned to him from the Muhlenberg Herbarium, for comparison.

Pending nominations Nos. 651 to 659 were read, and the Society was adjourned.

Provost C. J. Stillé then read an obituary notice of the late Mr. Horace Binney, Jun. (See Proceedings, page 371.)

OBITUARY NOTICE OF HORACE BINNEY, Jr.,

Read before the American Philosophical Society,

By Charles J. Stillé.

It is not often that the judgment of a man's life and character by the world agrees with that of his intimate friends. By the world, success in life is too often measured by results which strike most forcibly the popular imagination ;—it means a large fortune, a brilliant professional reputation, opportunities eagerly sought and adroitly taken advantage of, for gaining prominent public positions. To his friends on the other hand, a man may be most endeared and best remembered by qualities of which the world knows nothing, or at best knows them only as they are seen in the perfect symmetry of his life. Happy is the memory of him who, dying, forces the world to forsake for once the false standards by which it commonly judges character, and extorts from it an involuntary homage to what is real and true in human life. I think that the career of our late friend and colleague, Mr. Binney, is an illustration of this rare coincidence between the opinion of the world, and that of a man's inner circle of friends. Here was a man who won none of the great prizes of life as the world counts them, who was not a successful politician, who never aspired to high official position, or gained great professional reputation, who had none of the arts which please the multitude, who was simply a man of warm sympathies, and generous culture, striving to do his duty in the fear of God in that station of life in which his lot had been cast, a simple-hearted, modest Christian gentleman,—and yet when he dies, a voice comes to us made up of many voices, proclaiming that his conception of life was a just one, and that such a life is worthy of our affectionate commemoration.

Horace Binney, Junior, was born in Philadelphia, on the 21st of January, 1809. He was the eldest son of the Honorable Horace Binney, and one of the many blessings of his life was, that during the whole of it he felt himself supported by the wise counsel, the sure guidance, and the lofty example of such a Father. The influence of Fathers upon their children is, I fear, declining in this age and country, but in this case the deep yet discriminating affection of the Father for the son, and the profound filial reverence of that son towards the Father, forms a picture as attractive and suggestive, as unhappily in our experience it is rare. Such a relationship between two such men continued for threescore years, could not be without an important influence on both. By the younger, at least, it was felt as a power which he never referred to, except to speak of it with gratitude, as having happily controlled the whole course of his life.

As a boy, Mr. Binney was of a serious and thoughtful turn. His love of study, and his exquisite moral sense were developed simultaneously, and they soon became blended in that perfect harmony which formed the great charm of his character in his maturer years. He was somewhat shy and retiring in his disposition, and possibly a constitution never very robust, may have unfitted him for those boyish sports for the keenest enjoyment of which high animal spirits are essential. His studies began in the school of Mr. James Ross, and under the training of that most accomplished teacher he gained great proficiency in the Greek and Latin Classics. In this school, among his friends and associates, were the late Professor Henry Reed, Charles Chauncey, a young man of great promise, cut off in early manhood, and the Rev. Dr. Hare—and they remained his friends until death divided them. "He was remarkable among his school-mates" says the last survivor of these companions, "for the qualities which distinguished him in after life. He was to an unusual degree just, regular and industrious. I have no remembrance of his having ever missed a lesson or incurred a censure."

Mr. Binney entered the Freshman class in Yale College, in the autumn of 1824, in his sixteenth year. Although he was with one exception, the youngest member of a class nearly one hundred strong, his attainments in the classics were far beyond those required by the College rules for admission. This proficiency gave him of course a great advantage at the start, and was no doubt one cause of his high standing in his class. I well remember years afterwards at Yale a tradition, that Mr. Binney's class was one of the most brilliant which had ever passed through that College, and in this class he carried off the highest honors. Those who know what is meant at Yale by that distinction, can best estimate not merely the attainments, but the force of character required in a boy of twenty years of age to reach it. His friends at College, like his friends at school, seem to have been chosen from those whose subsequent career proves his early discriminating judgment of character. I need mention only the names of two of our most eminent colleagues, Mr. Justice Strong, and Dr. Barnard, President of Columbia College, who were his class-mates, and his life-long friends, in illustration of what I have said.

Perhaps however, the most powerful influence in moulding his character at this period of his life, came from a source outside the College. During the four years of his residence there, not a day passed in which a letter was not written by the Father to the son, or by the son to the Father. Such a correspondence could never have been maintained without that profound mutual confidence in each other which was a striking characteristic of both. It had too the inestimable advantage of making the Father and the son better known to each other, and one of its results was, that the Father who

had been the most careful and judicious of parents while his boy was at College, regarded him from the time he left it to the day of his death, as a younger brother rather than a son.

It is not to be supposed that because Mr. Binney attained the highest College honors, he had no time or inclination for studies beyond the ordinary *curriculum*. Although a firm believer to the last, in the simply disciplinary value of a thorough study of the Classics and the Mathematics, he never had the folly to suppose that four of the most precious years of his life were to be given merely to training his intellect, without storing his mind with knowledge, or cultivating his taste. His study of languages, and especially of Greek, led him into a far wider field than that embraced by an accurate knowledge of their grammar and their idioms. His proficiency was such that he was able to do that which few young men at College ever do, to regard the ancient languages principally as the vehicles of the literature of the people who spoke them. He was thus led to study in the best way, the civilization of the free states of antiquity. No one had a finer appreciation of what modern culture owes to Greek models. He himself was thoroughly imbued with their spirit, and their influence was conspicuous in liberalising his views and directing his studies all through life.

There can be, I suppose, little doubt that Mr. Binney's strong religious nature inclined him after he left College to adopt as a profession, that of the Sacred Ministry. That he acted wisely in not following this inclination, no one who now looks back upon his career can doubt. Mr. Binney's life as a layman was a living epistle of all virtues, a daily exhibition in the midst of no ordinary trials and duties, of purity, goodness, faith and truth, and it is not to be doubted that the silent influence of such a life upon those around him was as powerful and as healthful as if he had been the most brilliant professional teacher of those Divine truths, the fruits of which were so conspicuous in his daily walk and conversation. There is no warrant for the statement which has been made, that he wished to devote himself to the Ministry, and that he was persuaded by his Father to study Law. His Father, no doubt wished and recommended it, but his intervention was confined to pointing out the priceless value of the life of a truly religious layman in the world, and more particularly that among such religious men in England, were to be found several of her most eminent Judges and Lawyers. No one, indeed, who knows how solemn a thing duty always was with Mr. Binney, and how absolute was the confidence which his Father reposed in him, can doubt that the decision when arrived at, was the result of his own free and deliberate choice.

Mr. Binney's career as a Lawyer was not a striking or brilliant one. He studied his profession, as he did everything he undertook,

thoroughly and conscientiously, and his well-trained mind, and habits of industry, made him a master of the great principles of the science. But he was never intended for a professional *athlete*. He had none of the abundant self-assertion, the eager watching of opportunity for advancement, or the disposition to regard litigation as a game, the chief interest of which lies in the chances of success of those who conduct it, which are so characteristic of one class of Lawyers, while he had not those extraordinary gifts which make the fame of the truly great Lawyer, like that of the great Historian, one of the rarest of intellectual distinctions. He was however without doubt, one of those who do most to secure for the Profession the confidence of the Public. His nature abhorred all the arts of low cunning and chicanery, or rather with a certain noble simplicity, he seemed scarcely aware of their existence, and he lived in a moral atmosphere so pure, that it inspired every one who approached him with implicit trust and confidence. Hence in that large class of cases (much larger than is commonly supposed), in which the moral qualities of the man are quite as important to the interests of the client as the professional skill of the lawyer, he found abundant occupation. He was eminently a safe counsellor, accurate and thorough, and perfect master of any case which had been confided to him. I have been assured by one of the most eminent living Jurists, that there are at least two cases in our Reports in which Mr. Binney's printed arguments have always seemed to him models of Professional skill, showing on his part perfect familiarity with some of the most intricate and difficult questions of the Law.

Mr. Binney's extreme modesty, and his utter aversion to display or ostentation of any kind, confined his reputation as a scholar chiefly within the limits of those who knew him well. To his friends he seemed always a man of genuine scholarly instincts, loving the familiar intercourse of the wise, the true, and the good of all ages, as a means of enriching and invigorating his own nature. His memory abounded with passages from his favorite Latin authors, and he studied Greek literature, and especially the Greek Scriptures in a thoroughly critical spirit. I have often heard him refer to certain expressions in the original, the peculiar significance of which he thought had been lost in the translation. He talked often of St. Paul as one of the finest specimens of Greek culture, and nothing could be more instructive than to listen to his analysis of the speech before Agrippa, and of its points of resemblance to the most celebrated productions of the Greek orators. He referred frequently to the connexion between Greek culture, and the spread of Christianity, and to the providential combination for that purpose at the time of its Advent, of the Jewish or Monotheistic idea of the Deity, of the Greek conception of the dignity of man, and of the universal Roman

sway. He was fond of the study of history, but its chief interest to him, was as a record of the dealings of God with his creatures, and of the influence of the Church as a divinely organized institution in the world. His familiarity with ancient literature and ancient history never tempted him as it has done so many scholars in our day, to make it the basis of a destructive criticism which would leave us no Divine revelation, and no personal God. If he abstained, it was not from indifference, nor from a fear of the consequences, but because no man ever had a clearer intellectual perception than himself, of the boundaries between the domain of faith and that of reason.

The classical spirit with which Mr. Binney was imbued, formed the basis of all his canons of taste and criticism. He had learned at least one thing from the Greeks which so many are apt to forget, and that was the value of simplicity and truth in style. He had a great dislike for everything that was exaggerated, abnormal, or simply pretentious. Like Plato, he sought the beautiful by striving to find the true, and any picture in which truth and reality were sacrificed to effect failed to make the intended impression upon him. He thought that the ancient Poets and Dramatists pourtrayed most truly human emotions and passions, because their descriptions were at least consistent and natural, and because they did not present to us as real human beings, those literary monsters of modern times,—"the names linked with one virtue and a thousand crimes." He had the keenest perception of what was of real value, either in the form or in the substance of the writings of others. He especially disliked that mode of presenting or discussing a subject which was simply rhetorical, passionate, or sensational. Such a style offended equally his moral, and his æsthetic principles. It was not true because it was one-sided, and there was no beauty to him in anything which was not true. I have always regarded Mr. Binney as one of the best illustrations I have ever met with, of the practical value of classical studies, and I may mention here that during his long service as a Trustee of the Protestant Episcopal Academy,—extending over a period of nearly forty years,—and as a Trustee of the University, he was unceasing in his efforts to uphold their dignity, and in insisting upon their value in every scheme of liberal culture.[1]

[1] The following anecdote will illustrate Mr. Binney's familiarity with Greek style.

Mr. Richard Henry Wilde, once a member of Congress from Georgia, and an accomplished scholar, had written some beautiful verses beginning, "My life is like the summer rose, &c.," which being published in the newspapers, became widely known. Some time after, Mr. Wilde was surprised to find in a Georgia newspaper, a Greek Ode purporting to have been written by Alcæus, an early Eolian poet of somewhat obscure fame, and it was claimed that Mr. Wilde's verses were simply a translation of this Ode, the ideas in both being almost identical. As Mr. Wilde had never heard of Alcæus, he was much puzzled to account for this resemblance of the two poems. At the suggestion of a friend, the Greek Ode was sent to Mr. Binney for examination and criticism. He at once, much to the relief of Mr. Wilde, pronounced it a forgery, pointing out wherein its style differed from that of classical Greek. It turned out afterwards that the Ode in question had been written by an Oxford scholar on a wager that no one in that University was sufficiently familiar with the style of the early Greek poets, to detect the counterfeit. To carry out this scheme, he had translated Mr. Wilde's verses into Greek.

It is not to be inferred from what has been said, that Mr. Binney led the life of a secluded student, for he felt the deepest interest in the great movements which were going on around him, yet it is also true that he had no ambition to occupy a prominent position in public life. The arts of the politician were abhorrent to every instinct of his nature, and he felt, as we all do, that by these arts success is chiefly gained in a public career. He was one of that class, who, observing quietly the current of human affairs, are not disposed to make vain efforts to check its course until it threatens to sap the foundations of society, and those who have hitherto guided it lie panic-stricken and helpless. Such men form the true reserve force of a nation; never seen, almost never thought of in days when all is smooth and prosperous, they are the only guides who are trusted in the crisis of danger. Mr. Binney was a typical man of this class. He was forced into public life when earnest men sought to purify our Municipal Government, or when the suppression of riot and bloodshed in his native city, required him to assume the singularly uncongenial duties of a Captain of a Volunteer Company.

In his religious opinions, Mr. Binney was a conservative Churchman. He had deeply studied the organization and claims of the Christian Church, and was strongly convinced of the rightfulness of its authority as a Divine agency in this world. With a most devout and earnest spirit, he strove through this means to uphold a high standard of Christian life and duty. He revered the memory of the Saints and Martyrs of that Church. The virtues which distinguished them—child-like faith, humility, self denial, and an earnest love of the weak and the lowly—were those which found in him the fullest recognition and sympathy. His moral instincts and his mental culture were here also in perfect harmony, and his enthusiasm for Saintly George Herbert, and his familiarity with Keble's Christian Year, which he could repeat from beginning to end, were due, not merely to his appreciation of the literary merits of those Poets, but also to their praise of those virtues which it had been his life-long concern to cultivate.

Mr. Binney's peculiar views concerning the Church and its functions, modified his opinions upon many important questions, especially in regard to those great movements of moral reform by which the present age is so strongly characterized. With an ardent desire that men should grow purer and happier, his sober and serious judgment made him very slow in adopting any one of the plausible schemes by which it was proposed to accomplish that desirable object. He was no humanitarian. He had very little hope for the future of the race outside the influence of Christian faith and duty. He saw too much of the disturbing passions of mankind to believe that true progress could be made in any other way. In all his work for his fellow-

men he was guided by a principle far deeper and more enduring than a vague sentiment of philanthropy, and that was, obedience to a duty divinely commanded. Hence his zeal had all the characteristics of duty,—courage, constancy and self-denial—and none of the weaknesses attendant upon mere passionate impulse.

How completely Mr. Binney's whole life was the outgrowth of this principle of duty was shown by his conduct during the war. He had no favorite theories to establish, no passions to gratify by the subjugation of the Southern people. Moreover, he was one of those who, while he deplored most deeply the evils of slavery, felt himself bound by the force of positive law to abstain from interfering with it where it existed. Yet when a gigantic conspiracy to overturn the government of the country revealed itself, he regarded it with almost judicial calmness, and he prepared to resist it, as he would have performed any other high duty with all the manly earnestness of his nature. Shocked and indignant, no doubt, he was:

"Neque enim siluisse licebat,
Cum passos, mœrens indigna, Columbia crines
Et pectus lacerum et stillantia lumina monstrat."

Yet he never lost his balance: he went about his work with a sober enthusiasm which was deep-rooted in conscientious conviction. He never doubted or wavered, nor weakly desponded, but keeping his eye steadily on the end in view, he gave himself and all that he had to the support of the government. Nothing was more suggestive than the sight of this quiet, undemonstrative gentleman, in active sympathy with the country in danger. Of all the many schemes devised here to give popular aid to the authorities during the war, he was a most zealous promoter. He was one of the founders of the Union League of this City, an agency in the successful prosecution of the war, the value of which I do not think it easy to over-estimate. He was never unduly excited by our successes, or depressed by our reverses, and I do not think that I ever saw him more moved during the war, than when on a public occasion here, he expressed his satisfaction that he was at last permitted to give free play to his convictions concerning slavery, and to aid with a clear conscience in its destruction.

Mr. Binney's services during the war were not confined, as is well known, to a hearty support of the policy of the government. His active sympathy soon embraced those who were called upon to defend the country at the risk of their lives. He sought every opportunity to promote their health, comfort and efficiency. He helped to build up that great monument of American civilization, the United States Sanitary Commission, and he is entitled to a full share of whatever honor may be due to those who organized and carried on the grandest and most efficient system of voluntary relief to the sick and wounded of an Army known in History since wars began on earth.

He was elected on the thirtieth of July, 1861, by the gentlemen appointed by the President of the United States, a "Commission of Inquiry and Advice in respect of the Sanitary Interests of the United States Forces," a member of that body. His duties in this position were all engrossing. To do properly the work which the Commission had undertaken to do, which was nothing less than an attempt to supplement by the full measure of popular sympathy the deficiencies of the government service in the care of the suffering of the Army, required something more than mere devotion and zeal. If the whole project was not to end by increasing the very evils it sought to remedy, there was need of the utmost judgment, prudence and intelligence on the part of those who managed its affairs, in order to secure the harmonious co-operation of the army officials. In shaping and directing the policy of the Commission to this end, Mr. Binney was always conspicuous. On many occasions during its sessions in Washington, I was impressed with his sound and well-considered views, not merely in regard to the general objects of the Commission, but as to the best methods of securing them. His judgment was always so sure and calm, his counsel so wise and patriotic, that he soon gained the fullest confidence of his colleagues, many of whom were among the foremost men in the country.

But Mr. Binney's care for the sick and the suffering of the Army during the war, did not end with this general supervision of the means to be taken to improve their condition. One of the methods adopted by the Sanitary Commission to organize popular sympathy on the widest basis, was the establishment of branch or tributary associations in different parts of the country. In pursuance of this plan, Mr. Binney was instructed to organize in December, 1861, such an association in this City. By his zeal and personal influence, he gathered round him many of our prominent citizens, who desired to aid in this great scheme of Army relief. Of this body, called the "Philadelphia Associates," Mr. Binney was Chairman during the war, and by means of its labors, more than a million and a half of dollars were contributed in aid of the purposes for which the Commission was established. It is impossible, it seems to me, to recall the vast proportions which this work assumed without admiration, wonder and gratitude. Under Mr. Binney's wise and earnest leadership, it collected vast supplies from the homes of the country, and distributed them to the suffering of the Army, it supplemented the needs of the Military Hospitals, local and general,—it was foremost in relieving the miseries of battle-fields; it established a Hospital Directory, by means of which the condition of the suffering soldier, in any Military Hospital, might become speedily known to his friends, and it maintained a Bureau for the purpose of collecting the soldiers, claims on the government without charge to him. To carry on this

great scheme, it secured large contributions from our citizens, and as its crowning work, it organized the Great Central Fair in 1864—an enduring memorial, not merely of the patriotism and mercy of the people of Philadelphia, but also a wonderful proof of their perfect trust that their vast benefactions would be wisely administered by Mr. Binney, and the gentlemen associated with him.

It has sometimes been said that the war and its duties, brought into active excercise qualities in many men which had lain dormant all their lives, and of the existence of which they themselves had hardly been conscious. But in Mr. Binney's case, the war only offered an opportunity for an exhibition on a wider sphere of virtues, which had been his essential characteristics through life. He had courage, for instance,—not mere coolness in the midst of danger, although he possessed that to an eminent degree,—but a much loftier quality, which the French call the courage of one's opinions. His convictions were intensely strong, and when once formed, no power on earth would move him. Out of every conviction grew a duty, which soon brought forth fruit in an appropriate act. No one who knew Mr. Binney, could doubt his perfect readiness to maintain opinions so formed, with the courage and constancy of a martyr. And yet there was at all times in him, such true modesty, and a manner so unassuming, and almost shrinking, that to many the real strength of his nature lay hidden. His largeness of view, and his innate sense of courtesy, preserved him from the slightest taint of arrogance when he differed from others. Certainly, no opinions were held by Mr. Binney more strongly or clearly, than those concerning the nature and the functions of the Church, and yet I have seen him in the most intimate personal relations with representatives of almost every type of thought on this subject, except his own, at all times most zealously co-operating with them in the performance of duties demanded by a common Christianity.

As Mr. Binney was earnest and constant in his devotion to any cause the success of which he had at heart, so he was enthusiastic in his attachment to those whom he honored with his friendship. This is a trait of his character which I think is little understood. Few suspected what a fount of generous affection and tenderness lay hidden under that quiet and undemonstrative exterior. When he once trusted a man, he seemed to give himself up wholly to him. The only instances which I can recall, in which his usually calm judgment was disturbed, arose from this intense desire to serve his friends. On one occasion I had urged him to support for an important position a gentleman in whose success I felt a deep interest. After listening patiently to what I had to say, he suddenly exclaimed: "*Do not press me, do you know that Dr.* ——— (the opposing candidate), *once saved my life?*" Then again, he was led to feel that one of his friends

had done some service to the country by his writings at a critical period of the war. From that hour his heart warmed towards that friend: he gave him his fullest confidence, he spoke in the most unmeasured terms of the value of his services, and whatever influence he could command, was thenceforth exerted to secure for him posts of trust and honor. And this is the man, with a heart as simple as a child's, and as tender as a woman's, who was thought cold and formal by those who did not know him.

Mr. Binney never fully recovered from the effects of an illness through which he passed about ten years ago. Within a few weeks of his death, a disease of the heart was rapidly developed, and he was snatched away from his family and friends with startling suddeness, on the third of February, 1870. He left a widow, the daughter of the late William Johnson, Esquire, of New York, the eminent Reporter, and the intimate friend of Chancellor Kent, and seven children.

His life seems to me to have been in its symmetrical beauty almost an ideal one. It was nurtured and strengthened by the two great principles out of which all true excellence springs, Trust in God, and Devotion to Duty:

> "Thus it flowed
> From its mysterious urn a sacred stream,
> In whose calm depths the beautiful and pure
> Alone are mirror'd; which, though shapes of ill
> May hover round its surface, glides in light,
> And takes no shadow from them."

OBSERVATIONS ON THE FISHES OF THE TERTIARY SHALES OF GREEN RIVER, WYOMING TERRITORY.

By Prof. E. D. Cope.

Physoclysti.

Asineops, Cope, gen. nov.

Fam. squamipennes. Branchiostegal radii, seven; ventral radii I. 6–7. Opercular and other cranial bones unarmed; scales cycloid. Spinous and cartilaginous dorsal fins continuous; caudal rounded; anal with two spines. Lateral line distinct, not interrupted. Operculum with regularly convex posterior border. Teeth coarsely villiform, without canines. Both spinous and soft portions of dorsal and anal fins moderately scaly.

This well marked genus is established on the remains of fifteen individuals, in various states of preservation, so that the characters undistinguishable in one, can be discovered in another. Thus the lateral line is preserved in one only, and the teeth in another. In none can I be entirely sure that I see the vomer.

The scales are preserved in many specimens, and I cannot find a ctenoid margin in any, nor any radiating sculpture, but delicate concentric ridges continued round the central point proximally, distally forming parabolic

curves, the less median not completed but interrupted by the margin of the scale. Near the margin all the ridges become gently zig-zagged.

There is no depression between the two portions of the dorsal fin, though the cartilagius portion is the more elevated. Laid backwards, the latter is in line with the extremity of the anal, and both extend beyond the basis of the caudal.

The close affinities of this genus are difficult to determine with entire satisfaction. In its smooth cranial bones and united dorsals it is like the genera Apsilus Cuv. Val. of the Atlantic, and Micropterus Lac. of the fresh waters of North America. Its numerous ventral radii, agreeing with those of the Berycidæ (or Agassiz' section Holocentri in Poiss. Fossiles) separate it entirely from the above genera. The absence of the emarigination of the operculum, also distinguishes it from Micropterus. Its affinities are, however, entirely remote from the Berycidæ. The genus to which it stands in nearest relationship, is Pygæus, of Agassiz, which he refers to the Chætodontidæ, and which, if so referred, will intervene between the typical forms of the family, and the aberrant Toxotes. The only character by which I distinguish it from Pygæus, is the presence of one or two additional ventral radii, the number in the latter genus being I. 5. Nine species of that genus are described in the Poissons Fossiles all from Monte Bolca, and the existence of the present near ally, suggests a determination of the age of the Green River beds, which the other species do not furnish. This would be upper Eocene.

ASINEOPS SQUAMIFRONS, Cope, sp. nov.

General form is sub-oblong, the greatest depth just behind the head, and contained two and a half times in the length exclusive of caudal fin. Radii D. VIII, 14; A. II, 9; C. 14; V.I, 7; P. ?11 ?13. Scales 5—?30—10, vertical line counted a little behind the ventral fins. The line of the extremities of the second dorsal and anal fins, marks the basal third of the caudal fin. The dorsal spines are sub-cylindric, slightly curved, and of nearly equal length; the length equals the depth of the body at the middle of the second dorsal fin.

The external series of villiform teeth are stout of their kind, conic, and a little incurved. I cannot see the pharyngeal bones or teeth.

The number of vertebræ which extends between the caudal fin and the superior margin of the operculum, where one or more are concealed, is twenty-five, of which fifteen are of the caudal portion (in two I can only count fourteen).

The mouth is directed obliquely downwards and is rather large; the mandible, when closed, does not project beyond the premaxillary border. The maxillary, where preserved, is narrow distally, and does not project beyond the posterior line of the orbit. The latter is rather small, and though not well defined in any specimen, is not more than one-eighth the length of the head, and 1.5 to, 1.75 times inside of muzzle. The margins of all the opercular bones are entire and smooth. The interoperculum is narrow, and lies obliquely upwards, narrowing the operculum. The

greatest width of the latter is more than two-thirds its depth. The pelvic supports of the ventral fins are slender, and about half the length of the fin. The pectoral fins are not elongate.

The scales extend over the top of the head to or beyond the orbits. They also extend out on the ramus of the under jaw. Those of the fins are quite small; they extend to a considerable distance on the unpaired and on the caudal fins.

	M.
Total length of the largest specimen	0.19
Do. No. 2, smaller example (with caudal)	0.12
Length of head of do.	0.044
Depth of do. posteriorly about	0.036
Length base spinous dorsal	0.0265
" posterior " ray	0.017
" operculum	0.0125
" maxillary bone about	0.0145
Depth No. 3, at base 1st dorsal	0.045
" " " " anal, 1st ray	0.0325
Length basis anal—basis caudal	0.0162
" caudal fin	0.034

Tertiary strata of Green River, Wyoming; Dr. F. V. Hayden, Coll. Mus. Smithsonian.

CLUPEA HUMILIS, Leidy.

Proc. Acad. Nat'l Sciences, 1856, 256.

Vertebræ 34. Depth $2\frac{1}{2}$ to $2\frac{2}{3}$ lines in length exclus caudal fin ($2\frac{1}{4}$ times, Leidy). Scales large; l. transverse 11–12.

A very abundant species in the shales.

CLUPEA PUSILLA, Cope.

Greatest depth contained four times in the total length, or 3.5 times to basis of caudal fin. Length of head 3.2 to basis caudal;—this measurement may require revision, as the end of the muzzle is slightly injured. Orbit large, contained twice in length of head behind it. Middle of dorsal near the middle of length, and about over the origins of the ventrals. D. II. 11, V. 7. Pectorals extending half way to ventrals. Vertebræ 29–30, dorsals 19–20. Ventral keeled ribs 18. Anal fin lost. Caudal peduncle slender, caudal fin deeply furcate. Length M. 044; greatest depth M. 011.

The present species is about half the size of the last, and of considerably less proportionate depth.

CYPRINODON LEVATUS, Cope.

Anterior margin anal fin commencing a little behind opposite the posterior margin of the dorsal. Vertebræ 10. 14. I. Radii D. 8, A. II. 8, V. 8. Caudal fin deeply furcate; first anal ray strong.

General form elongate, the greatest depth contained three times in the length between the scapular arch and the basis of the caudal fin. Scales preserved, small; seven longitudinal series above, and seven below the vertebral column, probably two rows concealed by it. The caudal peduncle is rather contracted for the genus. Length from scapular arch to extremity of caudal M. 0335; depth at origin dorsal fin M. 008.

There are portions of five individuals on the slab of slate, but none present a clear cranium. This slab represents that portion of the stratum which is highly carbonaceous, portions of it thrown into the fire burn freely. Dr. Hayden, who has brought numerous specimens from this locality, informs me that the laminæ exhibit great numbers of these little fishes. No doubt the carbonaceous character of the shales is due to the decomposition of their bodies. The character of the species, as well as nature of the deposit, and mode of preservation, remind one strongly of the Cyprinodon meyeri, of Agassiz, from the neighborhood of Frankfort a. M. That species differs especially in presenting 18 Anal radii.

Some of the specimens above described were obtained and preserved for scientific study, by David B. Collier, formally United States District Attorney for the Territory of Wyoming.

From a Tertiary deposit on the upper waters of Green River, Wyoming Territory, from a laminated calcareous rock similar in color and appearance to the clay beds of Mount Lebanon and Mount Bolca. The first indication of the existence of this deposit was brought by Dr. Jno. Evans, who obtained from it a Clupeoid, which was described by Dr. Leidy, as *Clupea humilis* (Proc. Acad. Nat. Sci., Phila., 1856, p. 256). One of the blocks contains the remains of two small shoals of the fry, probably of Clupea humilis, which were caught suddenly by a slide or fall of calcareous mud, and entombed for the observation of future students. They must have been taken unwares, since they lie with their heads all in one direction as they swam in close bodies. One or two may have had a moment's warning of the catastrophe, as they have turned a little aside, but they are the exceptions. The fry are from one-half to three-quarters of an inch long and upwards.

True herring, or those with teeth, are chiefly marine, but they run into fresh waters and deposit their spawn in the Spring of the year, and then return to salt waters. The young run down to the sea in Autumn and remain there till old enough to spawn. The size of the fry of the Rocky Mountain herring indicates that they had not long left the spawning ground, while the abundance of adults suggests they were not far from salt water, their native element. To believe, then, that the locality from which the specimens were taken was neither far from fresh, nor far from salt waters, is reasonable; and this points to a tide, or brackish inlet or river. Lastly, the species of Cyprinodon inhabit also, tide and brackish waters. Most of the species of the family, as well as of the genus, are inhabitants of fresh water; but they generally, especially the Cyprinodons proper, prefer still and muddy localities, and often occur in water really salt. This habitat distinguishes them especially from Cyprinidae (Minnows and Suckers) and Pike.

The material which composes the shales indicates quiet water, and not such as is usually selected by herring for spawning in; while the abundance of adult Clupeas indicate the proximity of salt water.

This is far from a satisfactory demonstration of the nature of the water which deposited this mass of shales, but is the best that can be obtained with such a meagre representation of species.

As to geological age, the indications are rather more satisfactory. The genus Clupea ranges from the upper Eocene upwards, being abundant in the slates of Lebanon and Monta Bolca, while Cyprinodon has been found in neither, but first appears in the Middle or Lower Miocene in Europe. The Asineops resemble very closely, and I believe essentially, the Pygeaus of Agassiz, of Eocene age, from Monta Bolca. The peculiarities presented by the genus found by Dr. Hayden, are of such small significance as to lead me to doubt the beds in question being of later than Eocene age; though the evidence rests chiefly on this single, new and peculiar genus.

The position of these fishes, 7000 feet above the level of the sea, furnishes another illustration of the extent of elevations of regions once connected with the ocean, and the comparatively late period of Geologic time at which, in this case, this elevation took place.

Supplementary Notice of a new Chimærid from New Jersey.

Leptomylus cookii, Cope.

Indicated by a right inferior maxillary bone, of one-fourth the size of that indicating the *Leptomylus densus*. In general form the ramus resembles that of Ischyodus divaricatus, the posterior portion being curved outwards from the symphyseal. The latter region is much compressed and moderately prolonged, the inner face quite concave; posteriorly the outer face is also slightly concave. There is a single external crest, which is obtuse, and descends gradually to the plane of the beak, and presents no dentinal area. A single small oval area represents the internal, so large in Ischyodus. It lies along the inner margin. This margin is much thickened, and rolled over inwards; symphyseal face very narrow. The extremity of the beak is broken away, and the section shows that there is no inferior plate-like column, which produces the terminal area in most species of Ischyodus, but a round column, which issues on the upper surface of the beak, behind the apex.

	Lines.
Depth at posterior margin outer crest	25.4
" " anterior base " "	15.
" " end terminal column	6.8
Width of inner area	2.
" at " "	10.6
" " middle of beak	5.4

The apical dentinal column of this species distinguishes it from the L. densus, Cope, where no such column exists. It may be noted that at the posterior fractured section of the jaw, the apical column is seen, while internal dental area is not, the latter occupying only a pocket, not a column.

This species approximates Ischyodus solidulus in the apical column, which has the same form in both. The two dentinal faces the latter possesses, are those of true Ischyodus.

From the upper marl bed of the Cretaceous of New Jersey, from near Mt. Holly. Dedicated to Prof. Geo. H. Cook, under whose auspices the palæontological interests of the State survey have been extended.

Stated Meeting, May 20, 1870.

Present, ten members.

MR. FRALEY, Vice-President, in the Chair.

A letter accepting membership was received from Maj. R. E. Williamson, dated San Francisco, May 10th, 1870.

A letter respecting the Byington MSS. was received from Prof. Jos. Henry, Sec'y Smithsonian Institute, Washington, D. C., May 16th.

Donations for the Library were received from the Academies at Turin, Berlin and Boston; the Annales des Mines, and Nature; the R. Astronomical Society: Essex Institute; Boston Public Library; Silliman's Journal; American Museum of Natural History in New York, and Dr. Wm. Duncan, of Savannah.

The death of Dr. Jas. Y. Simpson, of Edinburgh, was announced by the Secretary.

ON THE GEOLOGICAL AGE AND EQUIVALENTS OF THE MARSHALL GROUP.

BY PROF. A. WINCHELL,

DIRECTOR OF THE GEOLOGICAL SURVEY OF MICHIGAN.

PART II.[112]

IV. PRESENT STATE OF OUR PALEONTOLOGICAL KNOWLEDGE.

I come now to the most important and most interesting branch of this investigation. In order that others may be placed in full possession of all

[112] For Part I of this paper, see Proceedings American Philosophical Society, vol xi., p, 57 (March 5, 1869). Both Parts of the paper were presented to the Chicago meeting of the American Association for the Advancement of Science, August 11, 1868. It was not offered for publication in the Proceedings in consequence of its length. It was reported, however, in the Chicago newspapers, and the chief points were briefly stated in the *American Naturalist* for October, 1868, p. 445 Part I. was published in these "Proceedings" without alteration; and Part II., as here presented is unchanged, except in the omission of some detailed lists of fossils, and in the addition of a few remarks based on late discoveries in Tennessee and Pennsylvania, and which have been made public in these Proceedings, vol. xi., p. 245, etc.

the data upon which my forthcoming conclusions are to rest, I introduce here a complete list of the fossils of the Marshall Group, and its supposed equivalents in other States. As introductory to this, however, and as tending to exclude from consideration the series of shales which I have designated the Huron group, I offer a few remarks upon the paleontology of these strata as far as investigated.

The following is a complete catalogue of the fossils thus far determined:

Orthoceras Barquianum. Win.
Spirifera subattenuata, Hall.
" medialis, Hall.
" Huronensis, Win.
" pharovicina, Win.
" insolita, Win.
Retzia polypleura, Win.
Merista Houghtoni, Win.
Pleurotomaria Huronensis, Win.
Goniatites Whitei, Win.
Rhynchonella Huronensis, Win.
Orthis Vanuxemi, Hall.
" crenistria? Phil.
" Iowensis? Hall.
Chonetes setigera? Hall.
Cardinia complanata, Win.
Leptodomus clavatus, Win.
Solen priscus, Win.
Orthoceras gracilius, Win.

Four of the foregoing species I have identified, more or less doubtfully, with species from the Hamilton group. These are *Spirifera subattenuata*, *S. medialis*, *Orthis Vanuxemi*, and *O. Iowensis*. A species very similar to *O. Vanuxemi* exists, however, in the Waverly series of Ohio, and in strata of the same age in Illinois and Missouri. *Chonetes setigera (?)* of the list, ranges in New York from the Marcellus shale to the Genesee. *Leptodomus clavatus* closely resembles a *Grammysia*, a genus ranging from the Corniferous to the Chemung. The equivalencies of these rocks are not very precisely indicated from the paleontological data. That the formation is newer than the Genesee shale is demonstrated by its observed superposition. The paleontological evidence indicates, at least, that the fauna is older than that of the Marshall group; and this is all that is necessary. If this group of rocks is proven by stratigraphical superposition to be newer than the Genesee, it belongs either to the horizon of the Portage and Chemung, or to that of the Marshall. If its stratigraphical position, its lithological characters and its fossil remains indicate equally that it is not to be embraced in the same group with the Marshall, no alternative remains. *The Huron group, above the Black Shale, must correspond to the Portage and Chemung, or to some portion of them.*

The question is now narrowed down to this:—Having discovered a representative of the Portage and Chemung groups in the Huron shales and their equivalents, in Michigan and Ohio, ought we to unite with these shales the Marshall sandstones and their equivalents, and thus embrace these also in the zone of the Portage and Chemung?

I have furnished lithological and stratigraphical indications that this ought not to be done. Let us examine the paleontological evidence.

CATALOGUE OF THE KNOWN FOSSILS OF THE MARSHALL GROUP AND ITS SUPPOSED EQUIVALENTS IN THE UNITED STATES.[113]

NAMES.	References.	Mich. N.	Mich. S.	Ohio.	Ind.	Ill.	Iowa.	Mo.	Other States.
Spirophyton crassum, Hall	xvi. Rep. N. Y. Reg., 83		*	*				*	
Dictyophyton Newberryi, Hall	xvi. Rep. N. Y. Reg., 87			*					
" Redfieldi, Hall	xvi. Rep. N. Y. Reg., 88			*					
Lepidodendron corrugatum, Daw.	Qr. Jour. Geol. Soc. xviii. Pl. xii., fig. 10.	*							
" sp ?									
Sigillaria sp ?	Proc. A. P. Soc., xii., 260			*					
Syringodendron gracile, Daw.	Qr. Jour. Geol. Soc., xviii. Pl. xii., fig. 12.			*					
Lycopodites gracilis, Shum. sp.	Mo. Rep. II., 208, Pl. A, 11							*	
Rhachiopteris striata, Daw.	Qr. Jour. Geol. Soc., xviii.		*	*					
Cyclopteris ? Marshallensis, Win.	MS.						*		
Nullipora obtexta, White	Bos. Proc., ix., 33						*		
Lophophyllum calceola, W. & W.	Bos. Proc., viii., 305						*		
Zaphrentis elliptica, White	Bos. Proc., ix., 31						*	*	
" acutus, W. & W.	Bos. Proc., viii., 306						*	*	
" Ida, Win.	Phil. Pr., July, 1865, p. 111			*	*				Tenn
Sphenopoterium enorme, M. & W.	Phil. Pr., Oct., 1860, p. 448				*	*		*	
Conopterium effusum, Win.	Phil. Pr., July 1865, p. 111						*	*	
Syringopora Harveyi, White	Bos. Proc., ix., 32							*	
Alveolites vermicularis, McCoy	Brit. Cal. Fos., 1st Fasc. 69 Mo. Rep. viii., 218								
Favosites divergens, W. &. W.	Bos. Proc., viii., 306						*		
" (?) mancus, Win.	Phil. Pr., July, 1865, p. 112				*				
Leptopora typa, Win.	Phil. Pr., Jan., 1863, p. 3						*		
Trematopora (?) vesiculosa, Win.	Phil. Pr., Jan., 1863, p. 3			*			*		
" (?) fragilis, Win.	Phil. Pr., Jan., 1863, p. 3						*		
Synbathocrinus Oweni, Hall	xiii. Rep. N. Y. Reg., 111				*				
Pentremites Rœmeri, Shum.	Mo. Rep., II., 186							*	
" sp ?				*					
? Onychocrinus exculptus, Ly. & Cas.	Amer. Jour. [2] xxix., 78				*				
Platycrinus graphicus, Hall	Pamph. 11 Nov. 1863; xvii Reg. Rep., 54			*					Ky.
" contritus, Hall	" " " " 54			*					
" sp ?								*	
Actinocrinus Indianensis, Ly. & Cas.	Am. Jour. Sci. [2] xxix., 75				*				
" pistilliformis, M. & W.	Phil. Pr., Aug. 1865; Ill. Rep., III., 151					*			
" Coreyi, Ly. & Cas.	Am. Jour. Sci. [2] xxix., 76				*				
" Helice, Hall	Pamph. 11 Nov. 1863; xvii. Reg. Rep., 53			*					
" viminalis, Hall	" " " " 54			*					
" Daphne, Hall	" " " " 52			*					
" sp ?								*	
Bursacrinus Meekianus, Shum.	Mo. Rep., II., 188					*		*	
Cyathocrinus decadactylus, Ly. & Cas	Am. Jour. Sci. [2] xxix., 73				*				
" hexadactylus, Ly. & Cas.	" " " 74				*				
Poteriocrinus crineus, Hall	Pamph. 11 Nov. 1863; xvii. Reg. Rep., 56			*					
" Pleias, Hall	" " " " 57			*					
" Corycia, Hall	" " " " 57			*					
Forbesiocrinus communis, Hall	" " " " 55			*					N. Y.
" lobatus, *var.* tardus, Hall	" " " " 56			*					
" Kellogi, Hall	" " " " 56			*					
Scaphiocrinus (Poteriocrinus) Ægina Hall	" " " " 57			*					
" " Lyriope, Hall	" " " " 58			*					
" subcarinatus, Hall	" " " " 58			*					
" subtortuosus, Hall	" " " " 59			*					
Zeacrinus paternus, Hall	" " " " 59			*					
" Merope, Hall	" " " " 60			*					
Lepidechinus rarispinus, Hall	xx. Rep. N. Y. Reg., 295			*					Pa.

[113] This Catalogue is little more than a list of references to the original descriptions. There is undoubtedly a large amount of synonymy involved, but extended investigation will be required to eliminate it satisfactorily. The Catalogue, in its present form, will be found useful, it is hoped, to all occupied with researches in rocks of this age.

NAMES.	References.	Mich. N.	Mich. S.	Ohio.	Ind.	Ill.	Iowa.	Mo.	Other States.
Fenestella rhombifera, Phil.	} Mo. Rep., 218							*	
" sp?								*	
Lingula membranacea, Win.	Phil. Proc., Jan. 1863, p.3						*		Pa.
" Melie, Hall	xvi. Rep. N. Y. Reg., 24			*					
" Cuyahoga, Hall	" " " 24		*	*					
" ? subspatulata, M. & W.	Ill. Rep., III., 437			*					Tenn
Discina capax, White	Bos. Proc., ix., 30, (1862)			*			*		
=*D. Newberryi*, Hall	xvi. Rep. N. Y. Reg., 30, (1863.)								
" Gallaheri, Win.	Phil. Pr. July, 1865, p. 112		*	*					Pa.
" patellaris, Win.	" Jan., 1863, p. 4						*		
" Saffordi, Win.	Tenn. Rep., 1869, p.443; } Proc. A. P. Soc., xii., 248 }								Tenn
Producta arcuata, Hall	Iowa Rep., 518			*			*		
" concentrica, Hall	x. Rep. N. Y. Reg., 180	*	*	*	*		*		Tenn
" Cora, d'Orb.	Pal. Voy. en Amer. mer. 55			*					
" Cooperensis, Swal.	St. Louis Trans., I., 640			*			*	*	
" crenulata, Shum.	Mo. Rep., 218							*	
" curtirostra, Win.	Phil. Proc. July, 1865, p. 114						*		
" dolorosa, Win.	" " " 114			*					
" duplicostata, Win.	" " " 113		*	*					
" gracilis, Win.	" " " 112			*					
" lævicostata, White	Bos. Jour., vii., 230						*		
" minuta, Shum.	Mo. Rep., 218							*	
" morbilliana, Win.	Phil. Proc., July 1865, p. 113			*			*		
" Murchisoniana, de Kon.	} Genus Prod. Pl. xvi., 3				*			*	
	} Mo. Rep., 218								
" Newberryi, Hall	x. Rep. N. Y. Reg., 180			*					
? = *P. semireticulata*, Flem.									
" parvula, Win.	Phil. Proc., Jan. 1863, p. 4						*		
" pyxidata, Hall	Iowa Rep. Part II. p. 498				*			*	
" semireticulata, (Flem.) de Kon.	Monogr. Gen. Prod., 183		*	*		*	*		Pa.
" Shumardiana, Hall	Iowa Rep. Part II. p. 498			*				*	
" subaculeata, Murch.	Bull Geol. Soc., xi., 255							*	
Strophalosia ? nummularis, Win.	Phil. Proc., Jan. 1863, p. 4						*		
Chonetes Fischeri, Nor. & Prat.	Phil. Jour., III., 25						*		Tenn
" geniculata, White	Bos. Proc., ix., 29			?	?		*	*	
" Illinoisensis, Worthen	St. Louis Trans., I., 571	*		*	*		*		
= *C. Logani*, Hall, (not Nor. & Prat.)	Iowa Rep. Part II., p. 598								
" Logani, Nor. & Prat.	Phil. Jour., III., 30. Pl. II., fig. 12			*			*		
" mesoloba, Nor. & Prat.	Phil. Jour., III., 27			*					
" Michiganensis, Stevens	Am. Jour. Sci. [2] xxv. 262		*				*		Tenn
" multicosta, Win.	Phil. Proc., Jan. 1863, p. 5							*	
" ornata, Shum.	Mo. Rep., II., 202								
" pulchella, Win.	Phil. Proc., Sept. 1862, 410		*	*					Pa.
" Shumardiana, de Kon.	Monogr. 1re. part. p. 192								Ky.
Strophomena rhomboidalis, Wahl.	Act. Soc. Upsal., III, 65			*		*	*	*	
? Strophodonta arctostriata, Hall	N. Y. Rep. IVth Dist., 266			*					N. Y.
Hemipronites inæqualis, Hall, sp.	Iowa Geol. Rep., II., 490			*			*		Pa.
" inflatus, W. & W.	Bos. Proc., viii., 293			*			*		
" lens, White	Bos. Proc., ix., 28			*		*		*	
" ? umbraculum, (V. B.)	Anim. Foss., 222			*			*	*	Pa.
Orthis flava, Win.	Phil. Proc., July 1865, p. 117						*		
" Michelini, L'Evéillé, sp.	Mem. Geol. Soc., France, II., 39			*		*		*	Pa.
" Missouriensis, Swal.	St. Louis Trans., I., 639							*	
" occasus, Hall	xiii. Rep. N. Y. Reg., p. 111				*				
" resupinata, Phil.	Pal. Foss., Cornwall, 67					*		*	
" subelliptica, W. & W.	Bos. Proc., viii., 292			*			*		
" Swallovi, ? Hall	Iowa Rep. Part II., 597						*		
" Thiemei, White	Bos. Jour., vii., 231						*		
? " Vanuxemi, Hall	x. Rep. N. Y. Reg., 135			*			*		
Spirifera biplicata, Hall	Iowa Rep., 519			?		*	*		
" camerata, Morton	Am. Jour. Sci. [1] xxix. 150			*					
" Carteri, Hall	x. Rep. N. Y. Reg. 170 (1858)			*		*	*		Pa.
= *S. Vernonensis*, Swal.									
" centronota, Win.	Phil. Proc., July 1865, p. 118			*					
" Cooperensis, Swal.	St. Louis Trans., I., 643; Ill. Rep., II., 155				*			*	

Names.	References.	Mich. N.	Mich. S.	Ohio.	Ind.	Ill.	Iowa.	Mo.	Other States.
Spirifera Cooperensis, Swal.									
= *S. semiplicatus*, Hall	xiii. Rep. N. Y. Reg., 111								
? " cuspidata, Sow. (not Hall)	Min. Conch., III., 42							*	
" extenuata, Hall	Iowa Rep., 520		*	*			*		
" Grimesi, Hall	Iowa Rep., 604					*			
" hirta, W. & W.	Bos. Proc., viii., 293						*		Tenn
" latior, Swal.	St. Louis Trans., II., 86							*	
" lineata, Phil.	Geol. Yorks., II., 219							*	
" Marionensis, Shum.	Mo. Rep., II., 203			*				*	
? = *S. Vernonensis*, Swal.									
" Missouriensis, Swal.	St. Louis Trans., I,, 643							*	
? " mucronata, Con.	Ann. Rep. N.Y. 1841, p.54							*	
	Hall: N.Y.Rep.IVth Dist								
" Osagensis, Swal.	St. Louis Trans., I., 641							*	
? = *S. Curteri*, Hall									
" peculiaris, Shum.	Mo. Rep., II., 202					*	*	*	
" Sillana, Win.	Phil. Proc., July 1865, p. 119			*				*	
? " striata, Sow.	Min. Conch., III., 125							*	
" subrotundata, Hall	Iowa Rep. Part II., 521			*			*		
" Taneyensis, Swal.	St. Louis Trans., I., 645							*	
" texta, Hall	x. Rep. N.Y. Reg., 169				?				
" Waverlyensis, Win.	Proc. A. P. Soc., xii., 251			*					
" (Cyrtia) Hannibalensis, Swal.	St. Louis Trans., I., 648							*	
Cyrtia acutirostris, Shum.	Mo. Rep., II., 204							*	
" sp?				*					
Syringothyris typa, Win.	Phil. Proc., Jan. 1863, p. 7			*		?	*		Pa.
" Halli, Win.	Phil. Proc., Jan. 1863, p. 8		*				*	*	
" capax, Hall, sp.	Iowa Rep. Part II., 520						*		
Spiriferina binacuta, Win.	Phil. Proc., July 1865, p. 120						*		
" Clarkesvillensis, Win.	Phil. Proc., July 1855, p. 119							*	
" solidirostris, White	Bos. Jour., vii., 232			*			*		
Spirigera biloba, Win.	Phil. Proc., July 1855, p. 119				*				
" corpulenta, Win.	Phil. Proc., Jan. 1863, p. 6						*		
" crassicardinalis, Swal.	Bos. Jour., vii., 229						*		
" Hannibalensis, Swal.	St. Louis Trans., I., 649			*		*	*		
" Missouriensis, Win.	Phil. Proc., July 1865, p. 117			*				*	
" Ohiensis, Win.	" " " 118			*					
" Prouti, Swal.	St. Louis Trans., I., 649					*		*	
Nucleospira Barrisi, White	Bos. Jour., vii., 227						*	*	
Retzia Osagensis, Swal.	St. Louis Trans., I., 653							*	
" (?) Popeana, Swal.	St. Louis Trans., I., 654							*	
" sexplicata, W. & W.	Bos. Proc., viii., 294						*		
" (Acambona?) altirostris, White	Bos. Proc., ix., 28						*		
Atrypa sp?	Mo. Rep., 218							*	
Ambocœlia sp?				*					
" (Spirifera?) minuta, White	Bos. Proc., ix., 26					*		*	
Pentamerus Salinensis, Swal.	St. Louis Trans., I., 652							*	
" lenticularis, W. & W.	Bos. Proc., viii., 295						*		
Rhynchonella Barquensis, Win.	Phil. Proc., Sep. 1862, p. 408	*							
" camerifera, Win.	" " " 408	*							
" caput-testudinis, White	Bos. Proc., ix., 23						*		
" Cooperensis, Shum.	Mo. Rep., II., 204						*	*	
" gregaria. Shum.								*	
" heteropsis, Win.	Phil. Proc., July 1865, p. 121			*			*		
" Hubbardi, Win.	" Sep. 1862, p. 407	*	*	*					
" Marshallensis, Win.	" " " 408		*	*					
" Missouriensis, Shum.	Mo. Rep., II., 204; Ill. Rep., II. 153; Ib., III. 450			*	*	*	*	*	
" obscuroplicata, Shum.	Mo. Rep., 218							*	
" occidentalis, Shum.	" 218							*	
" opposita, W. & W.	Bos. Proc., viii., 294						*		
" persinuata, Win.	Phil. Proc., July 1865, p. 121						*		
" pustulosa, White	Bos. Jour., vii., 226			*			*		
" Sageriana, Win.	Phil. Proc., Sep. 1862, p. 407	*		*					Tenn
" subcircularis, Win.	" " " 408	*							
" ? tetraptyx, Win.	" July 1865, 120				*				
" unica, Win.	" " " 122						*		
" Whitei, Win.	" Sep. 1862, 407	*							
" (Retzia?) micropleura, Win.	" July 1865, 122	*							
" (Eatonia) obsolescens, Hall	xiii. Rep. N. Y. Reg., 111				*				
Centronella Allei, Win.	Phil. Proc., July 1865, p. 123			*		*	*		
" Flora, Win.	Pr. Am. Phil. Soc., xii., 254			*					

Names.	References.	Mich. N.	Mich. S.	Ohio.	Ind.	Ill.	Iowa.	Mo.	Other States.
Centronella Julia, Win.	Phil. Proc.,Sep. 1862,p.405	*							
Terebratula Burlingtonensis, White	Bos. Jour., vii., 228						*		
? " fusiformis, Murch. & V.	Geol. Russ., p. 65							*	
Ostrea patercula, Win.	Phil.Proc.,July 1865,p.124						*		
Pterinea cardinata, Win.	Phil.Proc.,Sep. 1862,p.412	*							
" crenistriata, Win.	" July 1865, p. 124		*						
=*Cardiopsis crenistriata*,Win	" Sep. 1862, p. 417			*					
" spinalata, Win.	" July 1865, p. 124			*			*		
" strigosa, W. & W.	Bos.Proc., ix., 31						*		
" ? undulata, M. & W.	Ill. Rep.. III., 456					*	*		
" Whitei, Win.	Phil. Proc., Jan. 1863			*			*		
Aviculopecten Caroli, Win.	" " " p. 9			*			*		
" circulus, Shum., sp.	Mo. Rep., II., 206							*	
? " duplicatus, Hall	N. Y. Rep., 264							*	N. Y
" gradocostatus, White	Bos. Proc., ix., 31						*		
" Newarkensis, Win.	Proc.A. P. Soc.,Jan. 1870, xii., 255			*					
" nodocostatus,W.& W.	Bos. Proc., viii., 296						*		
" occidentalis, Win.	Phil. Proc., Jan. 1863, p. 9			*			*		
" tenuicostatus, Win.	" " " 10		*	*	*		*		
Pernopecten limæformis, Win.	" July 1865, p.126			*			*		
=*Aviculopecten limæformis*, W. & W.	Bos. Proc., viii., 296								
" limatus, Win.	Phil.Proc.,July 1865,p.126			*			*		
" Shumardanus, Win.	" " " 126;						*		
	Ill. Rep., III., 453						*		
" ? (Amusium) Cooperensis, Shum.	Mo. Rep., II., 206			*			*	*	
Microdon reservatus, Hall	Prelim.Notice,part 2,p.33			*					
Posidonomya ambigua, Win.	Phil. Proc., Jan. 1863,p.10						*		
" mesambonata, Win.	" Sep. 1862, p. 420		*						
" Romingeri, Win.	" " " 420		*						
" Whiteana, Win.	" " " 420		*						
Dexiobia Whitei, Win.	" Jan. 1863, p. 11						*		
=*Cardiomorpha ovata*, Hall	Iowa Rep., part 2, p. 522								
+*C. parvirostris*, White	Bos. Proc., ix., p. 31								
" Halli, Win.	Phil.Proc.,Jan. 1863, p.11						*		
Pinna (?) Marshallensis,. Win.	" July 1865, p. 126		*						
Mytilus elongatus, Shu m	Mo. Rep., 218							*	
" fibristriatus, W. & W.	Bos. Proc., viii., 296						*		
=*Mytilarca fibristriata*, Hall	Prelim.Notice,part 2, p.24						*		
" occidentalis, W. & W.	Bos. Proc., viii., 297						*		
=*Mytilarca occidentalis*, Hall	Prelim.Notice, part 2,p.24								
" Whitfieldanus, Win.	Phil.Proc.,Sep. 1862, p.413	*	*				*		
=*Mytilarca fibristriata*, Hall	Prelim.Notice,part 2,p. 24								
Myalina imbricaria, Win.	Phil.Proc., Sep. 1862,p.412		*						
" Iowensis, Win.	" July 1865, p. 127						*		
" Michiganensis, Win.	" Sep. 1862, p. 411		*						
" pterinæformis, Win.	" " " 412	*							
" rara.[116] Win.	Proc. A. P. Soc. (hoc loco)		*						
=*M. aviculoides*, Win.	Phil.Proc.Sep. 1862, p. 412								
Orthonota phaselia, Win.	" Jan. 1863, p. 12						*		
" rectidorsalis, Win.	" Sep. 1862, p. 412		*						
" ventricosa, W. & W.	Bos. Proc., viii., 297						*		
Sanguinolites amygdalinus, Win.	Phil. Proc.,Jan. 1863, p. 13						*		
=*Modiomorpha* (?)*amygdalina*, Hall	Prelim.Notice,part2,p. 78								
" Æolus, Hall	" " 46			*					
" borealis, Win.	Phil.Proc.,Sep. 1862, p.415	*	*						
" concentrica, Win.	" July 1865, p. 128		*						
=*Cardinia concentrica*, Win.	" Sep. 1862, p. 413								
" cylindricus, Win.	" Jan. 1863, p. 13						*		
" ? flavius, Hall	Prelim.Notice,part 2,p.47			*					
" Iowensis, Win.	Phil.Proc., Jan. 1863, p.14						*		
" ? jejunus, Win.	" " 15						*		
" Marshallensis, Win.	" Sep. 1862, p. 415		*	*					
" naiadiformis, Win.	Proc. A. P. Soc., xii., 255		*	*					
" strigatus, Win.	Phil.Proc.,July 1865,p.127	*							
" sulciferus, Win.	" Jan. 1863, p. 14						*		
" unioniformis, Win.	" Sep. 1862, p. 414		*						
" valvulus, Hall	Prelim.Notice,part 2,p.46			*					

[116] The original name (*M. aviculoides*) is preoccupied by Meek & Hayden, for a Permian species.

NAMES.	References.	Mich. N.	Mich. S.	Ohio.	Ind.	Ill.	Iowa.	Mo.	Other States.
Sanguinolites (Cypricardia ?) Chouteauensis, Swal. sp.	St. Louis Trans., I., 96							*	
" " rigida, W. & W. sp.	Bos. Proc., viii., 300			*			*		
" " rhombea, Hall	N. Y. Rep., p. 291								N. Y.
" " securis, Win.	Proc. A. P. Soc., xii., 255			*					
" (Cypricardia) ventricosa, Hall. sp.	xiii. Rep. N. Y. Reg., 110				*				
Allorisma Hannibalensis, Shum.	Mo. Rep. II., 206		*	*			*	*	N. Y.
= *Grammysia Hannibalensis*, Hall	Prelim. Notice, pt. 2, p. 62								
Edmondia æquimarginalis, Win.	Phil. Proc., Sep. 1862, p. 413		*	*			*		N. Y.
" binumbonata, Win.	" " " 414		*						
" Burlingtonensis, W. & W.	Bos. Proc., viii., 301			*			*		
" contracta, Win.	Phil. Proc., July 1865, p. 110						*		N. Y.
= *Cypricardia contracta*, Hall	N. Y. Rep. IVth Dist. p. 202								
= *Edmondia? bicarinata*, Win	Phil. Proc., Jan. 1863, p. 13								
= *Sanguinolites rigida*, Hall	Prelim. Notice, part 2, p. 44, (1870)								
" elliptica, Win.	Phil. Proc., Jan. 1863, p. 13						*		
" Marionensis, Swal.	St. Louis Trans., I., 654							*	
" nitida, Win.	Phil. Proc., Jan. 1863, p. 12						*		
" nuptialis, Win.	" " 12						*		
" strigillata, Win.	" " 12						*		
Modiomorpha hyalea, Hall	Prelim. Notice, part 2, p. 79			*					
Cardiomorpha Julia, Win.	Phil. Proc., Sep. 1862, p. 416		*						
" modiolaris, Win.	" " 416		*						
" sulcata, de Kon.	Anim. Foss., 109							*	
" triangularis, Swal.	St. Louis Trans., I., 655							*	
" trigonalis, Win.	Phil. Proc., Jan. 1863, p. 15						*		
? = *C. rhomboidea*, Hall	Iowa Rep., part 2, p. 523								
Pholadella Newberryi, Hall	Prelim. Notice, part 2, p. 65			*					
Arca arguta, de Kon.	Anim. Foss., p. 116							*	
" Missouriensis, Shum.	Mo. Rep., 218							*	
" modesta, Win.	Phil. Proc., Jan. 1863, p. 15			*			*		
" sp ?	Mo. Rep., 218							*	
Macrodon cochlearis, Win.	Phil. Proc., Jan. 1863, p. 16						*		
" ovatus, Hall	Prelim. Notice, part 2, p. 15			*					
" parvus, W. & W.	Bos. Proc., viii., 299						*		
Ctenodonta bellaluta, Win.	Phil. Proc., July 1865, p. 128							?	N. Y.
= *Nucula bellatula* Hall	N. Y. Rep. IVth Dist., p. 196								
" hians, Win.	Phil. Proc., July 1865, p. 128				*				
= *Nucula hians*, Hall	xiii. Rep. N. Y. Reg., p. 110								
" Houghtoni, Win.	Phil. Proc., July 1865, p. 128		*						
= *Nucula Houghtoni*, Stev.	Am. Jour. Sci. [2] xxv., 262								
" Hubbardi, Win.	Phil. Proc. Sep. 1862, p. 417; July 1865, p. 128		*	*					
? = *Nuculites sulcatina*, Con.	Phil. Jour., viii., p. 250								
" Iowensis, Win.	Phil. Proc., July 1865, p. 128		*				*		
= *Nucula Iowensis*, W. & W.	Bos. Proc., viii., 298; Win. Phil. Proc., Sept. 1862, p. 418								
" microdonta, Win.	Phil. Proc., Jan. 1863, p. 16						*		
" sectoralis, Win.	" Sep. 1862, p. 418	*	*	*					
? = *Nuculites mactroides*, Con	Phil. Jour., vii., p. 249								
" Stella, Win.	Phil. Proc., Jan. 1863, p. 419	*	*	*					
Nuculana (Leda) bellistriata, Stevens, sp.	Am. Jour. Sci. [2] xxv., 261 Win. Phil. Proc., Sep. 1862, p. 419		*						Tenn
" " Barrisi, W. & W., sp.	Bos. Proc., viii., 298			*			*		
= *Palæaneilo Barrisi*, Hall	Prelim. Notice, part 2, p. 11								
" (Leda) dens-mammillata, Stevens, sp.	Am. Jour. Sci. [2] xxv., 261		*						
" " nuculæformis, Stevens, sp.	" " " 261		*						
" " pandoræformis, Stevens, sp.	" " " 261		*						
" " saccata, Win.	Phil. Proc., Jan. 1863, p. 16						*		
Palæaneilo attenuata, Hall	Prelim. Notice, part 2, p. 12			*					
Conocardium bovipedale, Win.	Phil. Proc., Sep. 1862, p. 419		*						
" Napoleonense, Win.	" " 419		*						
" pulchellum, W. & W.	Bos. Proc., viii., 299			*			*		
" Romingeri, Win.	MS.		*						
Isocardia ? Jennæ, Win.	Phil. Proc., Jan. 1863, p. 17						*		

Names.	References.	Mich. N.	Mich. S.	Ohio.	Ind.	Ill.	Iowa.	Mo.	Other States.
Cardiopsis jejuna, Win.	Phil. Proc., Sep. 1862, p. 417		*				*		
" megambonata, Win,	" " 417	*							
" radiata, M. & W.	" Oct. 1860; Ill. Rep., IL., 157				*	*			
= *Megambonia Lyoni*, Hall	xiii. Rep. N.Y. Reg. p. 110						*		
Cypricardella quadrata, W. & W.	Bos. Proc., viii., 300	*							
" Barquensis, Win.	MS.							*	
Cardinia occidentalis, Swal.	St. Louis Trans., I., 655						*		
Sanguinolaria leptogaster, Win.	Phil. Proc., Jan. 1863, p. 18		*						
" rostrata, Win.	" July 1865, p. 129		*						
" sectoralis, Win.	" Sep. 1862, p. 422		*						
" septentrionalis, Win.	" " 421		*						
" similis, Win.	" " 421		*						
Anatina Leda, Hall	xiii. Rep. N.Y. Reg. p. 110				*				
Solen Missouriensis, Swal.	St. Louis Trans., I., 655							?	
" quadrangularis, Win.	Phil. Proc., Sep. 1862, p. 422		*	*					
" scalpriformis, Win.	" " 422		*						Tenn
Conularia Byblis, White	Bos. Proc., ix., 22						*		Tenn
" multicostata, M. & W.	Phil. Proc., Dec. 1865, p. 252			*					
" Newberryi, Win.	" Jan. 1865, p. 130			*					
" Whitei, M. & W.	" Dec. 1865, p. 253			*					
" sp ?	Mo. Rep., 218	*						*	
Bellerophon Barquensis, Win.	Phil. Proc., Sep. 1862, 427			*			*	*	
" bilabiatus, W. & W.	Bos. Proc., viii., 304								
" cyrtolites, Hall	xiii. Rep. N.Y. Reg., 107; Win. Phil. Proc., Sep. 1862 p. 426; Ill. Rep. IL., 160		*	*	*		*		
" galericulatus, Win.	Phil. Proc., Sep. 1862, p. 426		*						
" lineolatus, Hall	xiii. Rep. N. Y. Reg., 107		*		*				
" Michiganensis, Win.	Phil. Proc., Sep. 1862, p. 427		*						
" nautiloides, Win.	" " 427		*						
" panneus, White	Bos. Proc., ix., 21						*		
" perelegans, W. & W.	" viii., 304						*		
" rugosisculis, Win.	Phil. Proc., Sep. 1862, p. 425		*						
" scriptiferus, White	Bos. Proc., ix., 21						*		
" vinculatus, W. & W.	" viii., 304						*		
" Whittleseyi, Win.	Phil. Proc. July 1865, p. 130			*					
Porcellia crassinoda, W. & W.	Bos. Proc., viii., 303						*		
" nodosa, Hall	Iowa Rep. Sup. to Vol. I, p. 4; Ill. Rep., III., 458					*			
" obliquinoda, White	Bos. Proc., ix., 21						*		
" rectinoda, Win.	Phil. Proc., Jan. 1863, p. 18						*		
Pugiunculus? (Theca) aculeatus, Hall	xiii. Rep. N. Y. Reg., 107		*		*				
Dentalium grandævum, Win.	Phil. Proc., Jan. 1863, p. 18						*		
" (?) Barquense, Win.	" Sep. 1862, p. 425	*							
Metoptoma undata, Win.	" July 1865, p. 131						*		
Platyceras æquilaterale, Hall	Iowa Rep., Supp.					*			
" bivolve, W. & W.	Bos. Proc., viii., 302			*			*		
" corniforme, Win.	Phil. Proc., Jan. 1863, p. 18						*		
" haliotoides, M. & W.	" 1866, p. 264; Ill. Rep., III., 458			*					
" Herzeri, Win.	Proc. A. P. Soc., Jan., 1870, p. 256			*					
" paralium, W. & W.	Bos. Proc., viii., 302			*			*	*	
" vomerium, Win.	Phil. Proc., Jan. 1863, p. 19			*			*		
" (Orthonychia) subplicatum, M. & W.	" 1866, p. 265; Ill. Rep., III., 457			*					
Pleurotomaria exigua, Win.	" Sep. 1862, p. 424	*							
" Hickmanensis, Win.	Proc. A. P. Soc., xii., p. 257		*						Tenn
" humilis, Win.	Phil. Proc., Sep. 1862, p. 424		*						
" Mississippiensis, W. & W.	Bos. Proc., viii., 302						*		
" (?) mitigata, Hall	xiii. Rep N. Y. Reg., 108				*				
" quinquesulcata, Win.	Phil. Proc., July 1865, p. 131						*		
" rota, Win.	" Jan. 1863, p. 19						*		
" Stella, Win.	" Sep. 1862, p. 424	*							
" tectoria, Win.	" Jan. 1863, p. 19						*		
" vadosa, Hall	xiii. Rep. N.Y. Reg., 108 Win. Phil. Proc., Sep. 1862, p. 423		*	*	*				
" Whitei, Win.	Phil. Proc. Sep. 1862, p. 423		*						
Murchisonia (Pleurotomaria ?) limitaris, Hall	xiii. Rep. N.Y. Reg. p. 108				*				

NAMES,	References.	Mich. N.	Mich. S.	Ohio.	Ind.	Ill.	Iowa.	Mo.	Other States.
Murchisonia neglecta, Win.	Phil. Proc., Jan. 1863, p. 20						*		
" prolixa, W. & W.	Bos. Proc., viii., p. 303			*			*		
" quadricincta, Win.	Phil. Proc., Jan. 1863, p. 19			*			*		
" (?) Shumardiana, Win.	" " 20						*		
" sp?	Proc. A. P. Soc., xii., 260						*		Pa.
Straparollus Ammon, W. & W.	Bos. Proc., viii., 301								N. Y.
=*E. depressus*, Hall, sp. (not *E. depressus*, Sby.)	N. Y. Rep. IVth Dist., p. 291								
" Barrisi, Win.	Phil. Proc., Jan. 1863, p. 20						*		
" cyclostomus, Hall, sp.	Iowa Rep., Part 2, p. 516						*		
" lens, Hall, sp.	xiii. Rep. N. Y. Reg. 109; Ill. Rep., II., 159				*	*		*	
" macromphalus, Win.	Phil. Proc., Jan. 1863, p. 20						*		
" obtusus, Hall, sp.	Iowa Rep., p. 523			*			*		
" spirorbis, Hall, sp.	xiii. Rep. N. Y. Reg. p. 107				*			*	
" sp?	Mo. Rep., 218								
Phanerotinus paradoxus, Win.	Phil. Proc., Jan. 1863, p. 21						*		
Holopea conica, Win.	" " 21						*		
" subconica, Win.	" " 21						*		
Machrochilus pinguis, Win.	" " 21						*		
Loxonema oligospira, Win.	" " 22						*		
" turritiformis, Hall	xiii. Rep. N. Y. Reg., 109					*		*	
Chemnitzia tenuilineata, Shum.	Mo. Rep., II., p. 20								
Holopella mira, Win.	Phil. Proc., Jan. 1863, p. 22						*		
Naticopsis depressus, Win.	" " 22						*		
?Orthoceras arcuatellum, Sand b.	Verstein. 165, Taf. xix. 2; Amer. Jour. Sci., [2], xxxiii., 355		*						
" Chemungense, Swal.	St. Louis Trans., I., 660							*	
" clinocameratum, Win.	Am. Jour. Sci. [2] xxxiii., 356	*							
" heterocinctum, Win.	Phil. Proc., Jan. 1863, p. 23						*		
" Indianense, Hall	xiii. Rep. N. Y. Reg., 107 Win. Am. Jour. Sci. [2], xxxiii., 354		*	*	*		*		
" Lathropianum, Win.	Am. Jour. Sci. [2] xxxiii. 357		*						
" Marshallense, Win.	" " " 256		*						
" multicinctum, Win.	Phil. Proc., Sep. 1862, p. 421		*						
" occidentale, Win.	Am. Jour. Sci. [2] xxxiii. 356		*						
" reticulatum, Phil.	Geol. Yorks., II., 238 Win. Am. Jour. Sci. [2], xxxiii, 257		*						
" robustum, Win.	Am. Jour. Sci. [2], xxxiii. 356		*						
" vittatum (?) Sand b.	Verstein. 165, Taf. xx., 9; Win. Am. Jour. Sci. [2] xxxiii, 355		*						
" Whitei, Win.	Phil. Proc., Jan. 1863, p. 22						*		
" sp.	Mo. Rep., 218							*	
Gomphoceras sp?				*				*	
" "	Mo. Rep., 218							*	
" "	" 218							*	
Nautilus (Trematodiscus), altidorsalis, Win.	Phil. Proc., 1862, p. 429		*						
" " digonus, M. & W.	" Oct. 1860, p. 470; Ill. Rep., II., 163				*	*		*	
" " discoidalis, Win.	Am. Jour. Sci. [2], xxxiii. 360		*		?				
" " ingentior, Win.	" " " 361		*						
" " Meekianus, Win.	" " " 360		*						
" " planidorsalis, Win.	" " " 358		*						
" " striatulus, Win.	" " " 358		*						
" " strigatus, Win.	Phil. Proc., 1862, p. 426		*						
" " subsulcatus, Phil.	Geol. Yorks., II., 233 Win: Am. Jour. Sci. xxxiii., 361		*						
" " trigonus, Win.	Am. Jour. Sci. [2], xxxiii. 358		*						

NAMES.	References.	Mich. N.	Mich. S.	Ohio.	Ind.	Ill.	Iowa.	Mo.	Other States.
Nautilus (Trematodiscus) trisulcatus, M. & W.	Phil. Proc. Oct. 1860, p. 470; Ib. Jan. 1861; Ill. Rep., II., 162			*	*				
" (Gyroceras?) gracile, Hall, sp	xiii. Rep. N. Y. Reg., 105				*				
" sp?	Mo. Rep., 218							*	
Phragmoceras expansum, Win.	Phil. Proc., Jan. 1863, p. 23						*		
Cyrtoceras Rockfordense, Win.	" July 1865, p. 132				*				
=*N.* (*Cryptoceras*) *Rockfordense*, M. & W.	" " 275								
=*Gyroceras Rockfordense*, M. & W.	Ill. Rep., III., 459								
? " tesselatum, de Kon.	Anim. Foss., 529	*							
" unicorne, Win.	Phil. Proc., Jan. 1863, p. 23						*		
" sp?								*	
Gyroceras Burlingtonense, Owen	Rep. Wis., &c., p. 581						*		
Goniatites Allei, Win.	Am. Jour. Sci. [2] xxxiii., 363; Sketches of Creation, p. 116, fig. 50		*						
" Andrewsi, Win.	Proc. Am. Phil. Soc. xii. 259			*					
" Holmesi, Swal.	St. Louis Trans., I., 659							*	
" Houghtoni, Win.	Am. Jour. Sci. [2] xxxiii., 363		*						
" Ixion, Hall	xiii. Rep. N. Y. Reg., 100				*				
? =*G. rotatorius*, de Kon.									
" Lyoni, M. & W.	Phil. Proc. Oct. 1860, p. 471			*	*				
=*G. Hyas*, Hall	xiii. Rep. N. Y. Reg., 102								
" Marshallensis, Win.	Am. Jour. Sci. [2] xxxiii. 362	*	*	*					
" Morganensis, Swal.	St. Louis Trans., I., 659							*	
" Ohiensis, Win.	Proc. A. P. Soc., xii., 259			*					
" opimus, W. & W.	Bos. Proc. viii., 305						*		
" Osagensis, Swal.	St. Louis Trans., I., 659							*	
" Oweni, Hall	xiii. Rep. N. Y. Reg., 100	*			*				
" propinquus, Win.	Am. Jour. Sci., [2] xxxiii., 365	*							
" pygmæus, Win.	" " " 366		*						
" Romingeri, Win.	Phil. Proc., Sep. 1862, p. 427		*						
" Shumardianus, Win.	Am. Jour. Sci. [2] xxxiii., 363	*		*					
Proetus (Phillipsia?) auriculatus, Hall	xv. Rep. N. Y. Reg., 107			*					
" " ellipticus, M. & W.	Phil. Proc. Dec. 1865, p. 267; Ill. Rep., III., 460					*			
" " Missouriensis, Shum.	Mo. Rep., II., 196			*				*	
" " Swallovi, Shum.	" " 196							*	
Phillipsia Doris, Win.	Phil. Proc. July 1865, p. 133			*	*				
=*Proetus Doris*, Hall	xiii. Rep. N. Y. Reg., 112								
" insignis, Win.	Phil. Proc. Jan. 1863, p. 24						*		
? " Maramecensis, Shum.	Mo. Rep., II., 199			*			*		
	Win. Phil. Proc., Jan. 1863, p. 24								
" Rockfordensis, Win.	Phil. Proc. July 1865, p. 133				*				
" Tennesseensis, Win.	Tenn. Rep. 1869, p. 445; Proc. A. P. Soc., xii., 259								Tenn
" sp?	Mo. Rep., 218							*	
Cythere crassimarginata, Win.	Phil. Proc. Sep. 1862, p. 429		*	*					
Helodus biformis, Newb. & Wor.	Ill. Rep., II., 77						*		
" placenta, Newb. & Wor.	" " 80						*		
Gyracanthus Alleni, Newb.				*					
Orodus multicarinatus, N. & W.	" " 62				*				
Pleurodictyum problematicum, Goldf.	Win.: Proc. A. P. Soc., xii., 260			*					

NOTE.—In the foregoing table, "Bos. Jour." = Journal Boston Soc. Nat. Hist.; "Bos. Proc." = Proceedings of same; "Ill. Rep.," "Iowa Rep.," "Mo. Rep.," "N. Y. Rep.," "Tenn. Rep.," = Geological Reports of Illinois, Iowa, Missouri, New York 1Vth District, and Tennessee, respectively; "Mich. N." and "Mich. S." = Northern and Southern outcrops of Marshall group; "Pamph." = Pamphlet issued Nov. 1863, republished in xvii. Reg. Rep., p. 50; "Phil. Jour." = Journal Academy of Natural Sciences, Philadelphia; "Phil. Proc." = Proceedings of same; "Prelim. Notice" = Preliminary Notice, &c., Preparatory for the Palæontology of N. Y.; "Rep. N. Y. Reg." = Appendix to Annual Report Regents of University, State N. Y., on condition of State Cabinet; St. Louis Trans." = Transactions Acad. Sciences, St. Louis.

From the foregoing catalogue, it appears that the total number of determined species, from rocks of the period under consideration, is, at present, 416. These are distributed in groups as follows:

Plants,	9	Porcellia,	4
Corals (Polypi),	13	Gasteropoda,	48
Crinoidea, &c.,	27	Cephalopoda,	46
Fenestella,	1	Trilobites,	9
Brachiopoda,	124	Ostracoids,	1
Lamellibranchiata,	116	Fishes,	4
Bellerophon,	13	Pleurodictyum,	1
Total,			416

The number of species known, but not identified, is 20.

The identified species have been collected in eleven detached districts or States, which have yielded, severally, the following numbers:

1. Northern Michigan	23
2. Southern Michigan	93
3. Ohio	139
4. Indiana	45
5. Illinois	27
6. Iowa	160
7. Missouri	77
8. Kentucky	2
9. Tennessee	13
10. New York	9
11. Pennsylvania	9
Total identifications	597

From this it appears there have been 181 identifications of species in two or more of the above regions. A further analysis of the geographical distribution of these species will set in a strong light the palæontological affinities of the several regions.

It might be admitted at once that the outcrop at Pt. aux Barques ("Northern Michigan") is of the same geological age as the typical formation in Southern Michigan; but as Messrs. Houghton and Hubbard [115] have separated the two series of outcrops as different formations, I desire to introduce the palæontological discussion, by setting at rest all controversy respecting the synchronism of the strata in the two Michigan districts. The following species occur in both regions:

Producta concentrica,	Ctenodonta sectoralis,
Rhynchonella Hubbardi,	" Stella,
Mytilus Whitfieldanus,	Goniatites Marshallensis.
Sanguinolites borealis,	

With 30 per cent. of the known species of the Pt. aux Barques sandstones identifiable with fossils from the Marshall sandstones, and with a

[115] See Part I. of this paper, p. 59.

stratigraphical and lithological conformity in the two series of sandstones (besides *Goniatites Oweni*, common to Northern Michigan and Indiana, *Chonetes Illinoisensis*, common to Northern Michigan, Ohio, Indiana and Iowa; *Cardiopsis megambonata*, common to Northern Michigan and Iowa, and *Goniatites Shumardanus*, common to Northern Michigan and Ohio), I think their geological equivalency can never hereafter be called in question.

In conducting the palæontological branch of the discussion of equivalencies among the western districts, it would be appropriate to cite here the lists of species identified in two or more of these districts. As this, however, would considerably extend the limits of this paper, and these lists are readily deducible from the "Catalogue" given, I present only the summaries. In doing this, I shall count the two Michigan districts as one, and shall also omit Kentucky, since I feel some uncertainty about the geological position of the two species recorded from that State.

Species common to	Michigan	and	Ohio,	27
"	"	"	Indiana,	9
"	"	"	Illinois,	1
"	"	"	Iowa,	13
"	"	"	Missouri,	3
"	"	"	Tennessee,	4
"	"	Ohio	and Indiana,	12
"	"	"	Illinois,	10
"	"	"	Iowa,	51
"	"	"	Missouri,	16
"	"	"	Tennessee,	4
"	"	Indiana	and Illinois,	5
"	"	"	Iowa,	7
"	"	"	Missouri,	5
"	"	"	Tennessee,	2
"	"	Illinois	and Iowa,	10
"	"	"	Missouri,	14
"	"	Iowa	and Missouri,	13
"	"	"	Tennessee,	5
"	"	three	States,	32
"	"	four	"	10
"	"	five	"	2

Should we unite *Producta Shumardana* and *P. pyxidata* with *P. concentrica*, the latter species would be known in seven different Western States, besides the Pt. aux Barques region.

With such an extended network of identifications, and with long lists of representative species which I forbear to cite, I believe it will be admitted that the several formations brought under comparison must have been accumulated in one geological period. Let it now be distinctly stated what are the formations which are thus synchronized. They are as follows :

1. The Marshall Group of Michigan.

2. The Gritstone and Waverly series of Ohio, down to the Chocolate Shales.

3. The Goniatite Limestone of southern Indiana, and its equivalent sandstone in northern Indiana.

4. The Kinderhook Group of Illinois.

5. The Yellow Sandstone series of Iowa, at least down to the bluish sandy shales.

6. The series known in Missouri as the Chouteau Limestone, the Vermicular Sandstone and Shale, and the Lithographic Limestone.

7. The Silico-bituminous Shales at the base of the Silicious Group of Tennessee.

For the sake of brevity and convenience I shall hereafter employ the term Marshall Group as the general designation for this formation in the Western States.

Let us next consider what are the paleontological relations subsisting between the Marshall Group and the Chemung and Portage and older formations of New York.

Professor Hall [116]has described from Summit County, Ohio, a crinoid under the name of *Forbesiocrinus communis*, which, he states, cannot be distinguished from a single specimen from the Chemung of Chatauque County, N. Y. At the same time he states that this species combines some of the characters of two types occurring in the Carboniferous Limestone. Another species, *Forbesiocrinus lobatus*, presents characters which he regards as constituting a variety (*Var. tardus*) of a species from the Hamilton Group[117]. A third species from the same locality, he regards as closely related to *Poteriocrinus diffusus*, of the Hamilton Group, though distinctly differing. At the same time Professor Hall notes no less than seven species from this locality which exhibit distinct affinities with species from the Burlington Limestone. We have in this assemblage of crinoids, therefore, two species identified with species from rocks which I regard as older than the Marshall, while nine species, including the two identified, sustain intimate relations with the fauna of the Carboniferous system, which Professor Hall assumes to be entirely above the zone of the Chemung.

The only other species from the Marshall Group which stand referred to strata as old as the Chemung are the following:

1. *Strophomena arctostriata* Hall, from Hobbieville, N. Y.,—doubtfully recognized at Cuyahoga Falls, Ohio.

2. *Orthis Vanuxemi*, Hall, which if not identical with *O. Michelini* L'Evéillé, a carboniferous species, is so closely related as to show that the type of *O. Michelini* began to exist during the Hamilton period. A species perhaps identical, has been described from Iowa as *O. Swallowi*, Hall; and *O. flava*, Win. from the same locality, belongs to the same group of forms.

[116] xvii, Rep. N. Y. Regents, p. 50.

[117] The analogue of this is *P. Giddingi*, of the Carboniferous Limestone. Hall, xv. Rep. N. Y. Reg. 124.

3. *Orthis resupinata* de Kon. ranges from the Devonian into the Carboniferous system both in Europe and America.

4. *Orthis Thiemei*, White, from Iowa, is reported by Professor Hall as identified in the Chemung of New York.

5. *Chonetes Logani* Nor, and Prat, is also reported by Professor Hall occurring in the Tully Limestone. I have heretofore expressed my dissent from this identification.[118] I pronounced the New York species distinct before being informed of its geological position or locality. It presents a series of concentric rugosities or wrinkles which extend both across the ribs and the intervals between the ribs, while in *C. Logani* the rugosities are feebler, and are confined to the crests of the ribs.

6. *Strophomena rhomboidalis*, Wahl, has a range even greater than that of *O. resupinata*.

7. *Spirifera mucronata* Con., found in the Chemung of Steuben County, N. Y., was doubtfully identified in Missouri. Not having seen the Missouri specimens, I would be strongly inclined to suspect that they belong rather to *S. extenuata*, or some related species.

8. *Ctenodonta bellatula*, Hall, sp. of the Hamilton group of New York, has also been doubtfully identified in Missouri.

A few additional species had been provisionally repo ted identical with Chemung forms, but as already stated, a direct compa ison of the species suspected to be identical has induced me to abandon the identification in every instance. We have then no unquestioned identifications with species from rocks as old as the Chemung, except in the case of *Orthis resupinata* and *Strophomena rhomboidalis*, and perhaps *Orthis Thiemei*. It is fair to presume that the forms of *Strophomena rhomboidalis*, occurring as high as the Marshall group, will yet be distinguished from the Silurian forms by appreciable characters, as has been done recently in respect to the forms of *Atrypa reticularis*.[119] The different expression of the Marshall forms has already been remarked. This species, so abundant in the Marshall period, existed in the Lower Silurian, and appears to have attained its culmination in the Upper Silurian. There is an improbability that the same species, after having once undergone a decline, should attain a second culmination in seas swarming with species and types of a much later period.

I think it will be admitted that the palæontological correspondence between the Marshall and the Chemung strata is extremely meagre. We know four hundred and fifteen species from the strata of the Marshall period, of which 138 come from Ohio, a State almost in continuity with the State of New York. We know probably 100 or 150 species from the Chemung of New York; and yet we are able to identify scarcely a single characteristic species with the types of the Marshall group. This state of the facts looks very unfavorable to the attempt to parallelize the Marshall and Chemung.

I proceed now to point out the specific facts bearing upon the relation subsisting between the Marshall fauna and that of formations in Western

[118] Proc. Acad. Nat. Sci. Phil. July, 1865, p 116.

[119] Whitfield: observations on the internal appendages of the genus Atrypa, 1866.

New York, which are newer than the characteristic Chemung. I have already stated that Professor Hall indicates the existence in Western New York, of three conglomerates which he regards as coming in consecutively above the typical Chemung. I have also stated that the consecutive arrangement is not established by any observed superposition. On an examination of the fossils of the so-called carboniferous conglomerate preserved in Professor Hall's magnificent cabinet, I at once identified the following Marshall species :

Straparollus Ammon, White.[120]
Cypricardia contracta, Hall = (Edmondia bicarinata Win.)
Edmondia æquimarginalis, Win.
Allorisma Hannibalensis, Shum.

Straparollus Ammon is from Iowa, though an undistinguishable form occurs in the coal measures of Lasalle, Illinois. *Cypricardia contracta* is also from Burlington, while *Edmondia æquimarginalis* is known in Michigan, Ohio and Iowa, and has a European analogue in *Cardina robusta* of J. de C. Sowerby ; and *Allorisma Hannibalensis* is known in Michigan, Ohio,[121] Iowa and Missouri. The whole number of species in the cabinet from this conglomerate did not amount, if I remember rightly, to more than eight, and here were four of them immediately and conclusively identifiable. Here is a percentage of identifications forty or fifty times as great as we have been able to make with fossils of Chemung age. It seems to me that we are within the limits of truth when we assert that the paleontological evidence points much more strongly to a synchronism between the Marshall group and this conglomerate, than between the Marshall and the Chemung.

When next I turned my attention to an examination of specimens from the reputed Chemung conglomerate, I remarked its lithological similarity to the former. and was able also to recognize among the fossils the following species identified in the other conglomerate :

Edmondia æquimarginalis.
Allorisma Hannibalensis.

Out of a very limited number of fossils in these two conglomerates, here were two completely identical. But for their reputed dissimilarity in age, any paleontologist would feel inclined to pronounce them synchronous. Biding the opportunity to make a re-examination of the grounds upon which Professor Hall has separated these two conglomerates ; and holding paleontological induction as always subordinate to stratigraphical demonstration, I shall provisionally regard as one the two conglomerates under consideration.

The so-called Chemung conglomerate rests upon typical Chemung strata. The outliers of the Catskill group in Western New York also rest, when-

[120] This was described by Hall as *Euomphalus depressus*, but as this name had been preoccupied by Sowerby, the name of White will take precedence.

[121] This and some others of the species identified in this paper from Ohio have very recently been sent rom Licking County by Rev. H. Herzer. P. S.—Others have been sent by Prof. E. Andrews, See. Proc. A. P. Soc. xii, 245.

ever seen, upon Chemung strata, and so do the outliers of the so-called Carboniferous conglomerate. Not only are the three similarly superposed, but they agree in presenting sometimes a conglomeritic character, and sometimes the character of a sandstone with oblique lamination. The carboniferous conglomerate near Panama, in Chatauque County, affords a fine building stone, and is quarried there for that purpose. Finally, I desire to recall the fact that the Marshall sandstone in the vicinity of Pt. aux Barques assumes a decidedly conglomeritic character, and presents the appearance of the conglomerate at Cuyahoga Falls in Ohio, with which the earlier Michigan geologists were inclined to identify it. I ought also to mention the fact that *Cypricardia Catskillensis*, figured and described by Vanuxem,[122] presents close analogies with two species from the Marshall group, *Sanguinolites unioniformis* and *S. naiadiformis*.

For these reasons, I shall, for the present, regard the three conglomerates in Western New York, with the associated strata, as belonging together in the horizon of the Catskill group.

I ought to cite here the results of some investigations which I have more recently made upon a collection of fossils from the sandstones of Venango County, Pennsylvania.[123] At a point near Shafer's, on Oil Creek, the following characteristic fossils of the Marshall group were recognized in April, 1869, and the results communicated to Professor E. Andrews, to whom I was indebted for the specimens.

Lingula membranacea.	Hemipronites umbraculum.
Discina Gallaheri.	Orthis Michelini.
Producta semireticulata.	Spirifera Carteri.
Chonetes pulchella.	Syringothyris typa.
Hemipronites inæqualis.	

This locality was reported by Prof. Andrews to be "200 to 300 feet below the coal." Every identifiable specimen belonged to the Marshall group. Judging from these data, there can be no doubt that this group extends into western Pennsylvania.

At Kinzua, however, not far from Shafer's, at a point thought by Prof. Andrews to be a hundred feet lower, geologically, quite a different fauna presented itself. Not a single Marshall species could be identified; while *Spirifera disjuncta* (Phillips) Hall, and fragments of lamelli branches which seemed to belong to *Avicula longispina* and *acanthoptera* Hall, proclaimed the horizon of the Chemung.

Since the recognition of the Marshall sandstones in northwestern Pennsylvania,[124] it becomes much easier to admit the evidence which I have already adduced in proof of their existence in southwestern New York. The physical character of these sandstones so closely resembles that of the Chemung rocks that the line of demarkation between them had not

[122] Geol. Rep. Dish. N. Y., p. 186.

[123] Proc. Amer. Phil. Soc., Jan. 4th, 1870.

[124] Professor Hall, in xx Rep. N. Y, Reg. p. 295, reports also *Lepidechinus rarispinus* from Meadville, Pa., and Licking County, Ohio. He argues from this a parallelism which I will not contest, but the fact establishes no affinity with the Chemung.

heretofore been recognized in that part of the country. Further east, however, where they become lithologically differentiated from the Chemung, they had long since been assigned a distinct position, both in Pennsylvania and New York.

V. The Fauna of the Marshall Group presents a Carboniferous Aspect.

I proceed in the next place to prove, on paleontological grounds, that the Marshall group possesses close affinities with the carboniferous system. These affinities are manifested in the presence of species identical with recognized carboniferous fossils of America and Europe; in the presence of species which may be regarded as the precursors or analogues of recognized carboniferous fossils, and in the dominance of generic and sub-generic types which attain their culmination during the carboniferous age.

1. Species identified with fossils from the carboniferous rocks of America:

Producta semireticulata Flem.	Coal measures.
" Cora d'Orb.	" "
Chonetes Illinoisensis Wor. (=C. Logani Hall).	Burlington Limestone.
" multicosta Win.	" "
" mesoloba N&P.	Coal measures.
Hemipronites umbraculum Von Buch.	" "
Orthis Swallowi Hall,	Burlington Limestone.
Spirifera lineata? Phil.	Coal measures.
" Grimesi Hall.	Burlington Limestone.
" camerata Morton.	Coal measures.
Nuculana bellistriata Stev. sp.	Coal measures.
Phillipsia Maramecensis? Shum.	Warsaw Limestone.

2. Species which extend up into the base of the Burlington Limestone at Burlington, Iowa:

Syringopora Harveyi White.	Restricted.
Trematopora? vesiculosa Win.	"
" fragilis Win.	
Syringothyris typa Win.	Restricted.
Pentamerus lenticularis W&W.	
Aviculopecten Caroli Win.	
Pernopecten limatus Win.	Restricted.
Ctenodonta microdonta Win.	
Platyceras corniforme Win.	
Pleurotomaria rota Win.	
Orthoceras Indianense, Hall.	
" heterocinctum, Win.	

The species marked "restricted" do not occur below the base of the Burlington Limestone at Burlington, but they are included here because the fauna proper of the Burlington Limestone begins above the narrow

basal zone containing the Marshall species. *Syringothyris typa*, moreover, is believed to occur in the Kinderhook group of Illinois. [It is now known also from Ohio and Pennsylvania.]

3. Species identified with fossils from the Carboniferous rocks of Europe:

Producta semireticulata Flem.	Spirifera lineata? Phil.
? " Cora d' Orb.	Orthoceras reticulatum Phil.
Hemipronites unbracutum V. Buch.	Nautilus subsulcatus Phil.
Orthis Michelini L'Evé.	Cyrtoceras tesselatum de Kon.
" resupinata de Kon.	

4. Fossils whose analogues recur in the recognized carboniferous rocks of America:

	Analogues.
Platycrinus contritus.	Platycrinus Burlingtonensis.
Actinocrinus Helice.	Actinocrinus unicornis.
" pistilliformis.	Actinocrinus pyriformis. Actinocrinus pistillus.
" viminalis.	" Whitei.
Poteriocrinus Corycia.	Poteriocrinus cauliculus.
Forbesiocrinus lobatus Var. tardus.	Forbesiocrinus Giddingi.
Scaphiocrinus subcarinatus.	Scaphiocrinus carinatus.
" subtortuosus.	" tortuosus. " carinatus.
Zeacrinus paternus.	Zeacrinus scoparius.
Lepidechinus rarispinus.	Lepidechinus imbricatus.
Producta arcuata.	Producta semireticulata.
Producta Newberryi.	Producta semireticulata.
" morbilliana.	" Rogersi.
Chonetes multicosta.	Chonetes Logani.
Orthis Vanuxemi?	Orthis Michelini.
" flava.	" "
Spirifera hirta.	Spirifera pseudolineata.
" Cooperensis.	" lineata.
Spiriferina Clarksvillensis.	Spiriferina subtexta.
Spirigera Missouriensis.	Spirigera subtilita.
Pernopecten Shumardanus.	Pecten aviculatus.
Myalina Iowensis.	Myalina angulata.
Edmondia Burlingtonensis.	Edmondia radiata.
Sanguinolites Chouteauensis.	Cypricardia transversa.
Ctenodonta Stella.	Nucula ventricosa.
Conocardium pulchellum.	Conocardium carinatum.
Cypricardella quadrata.	Cypricardella subelliptica.
Bellerophon perelegans.	Bellerophon cancellatus.
Dentalium grandævum.	Dentalium venustum.
Platyceras paralium.	Platyceras acutirostre.
Straparollus Ammon.	Euomphalus Spergenensis
Macrocheilus pinguis.	Macrocheilus primigenius.

5. Fossils whose analogues recur in the Carboniferous rocks of Europe:

Producta arcuata,	Producta semireticulata.
" morbilliana.	" punctata,
Orthis flava.	Orthis Michelini.
Rhynchonella Sageriana.	R. pleurodon Var. Devreuxiana.
Rhynchonella Whitei.	Rhynchonella radialis.
" subcircularis.	" "
" persinuata.	" pleurodon.
" ? tetraptyx.	Spirifer Buchianus. [mis.
" Missouriensis.	Rhynchonella pugnax & renifor-
Pterinea spinalata.	Avicula lunulata.
Pernopecten limæformis.	Pecten dissimilis.
Posidonomya Romingeri.	Posidonomya vetusta.
" mesambonata.	" "
Mytilus Whitfieldanus.	Modiola lingualis.
Myalina Michiganensis.	Myalina virgula.
" imbricaria.	" lamellosa.
Edmondia nitida.	Edmondia unioniformis.
" æquimarginalis.	Cardinia robusta.
" binumbonata.	Edmondia scalaris.
Sanguinolites concentrica.	Cardinia tellinaria.
Cardiomorpha modiolaris.	Cardiomorpha livida.
" Julia.	" Puzosiana.
Arca modesta.	Arca arguta.
Conocardium pulchellum.	Condocardium aliforme.
Bellerophon vinculatus.	Bellerophon bicarenus.
" rugosiusculus.	" decussatus.
" galericulatus.	" Urei.
Pleurotomaria humilis.	Pleurotomaria helicinoides.
Straparollus Ammon.	Euomphalus lævis.
Straparollus macromphalus.	Euomphalus lævis.
Orthoceras Indianense.	Orthoceras cinctum.
" robustum.	" giganteum.
" multicinctum.	" cinctum.
Nautilus trisulcatus.	Nautilus sulcatus.
" digonus.	" Edwardsianus, &c.
" planidorsalis.	" "
" trigonus &c.	" "
	" "
Cyrtoceras Rockfordense.	Cyrtoceras cyclostomum.
Goniatites Oweni.	Goniatites princeps.
" Ixion.	" rotatorius.
" Marshallensis.	" mixolobus &c.
" Lyoni.	" "
" pygmæus.	" striolatus.
" Romingeri.	" rotatorious.

6. Generic and sub-generic types of a carboniferous character. The most important genera possessing a paleontological value in this discussion are the following :

Actinocrinus.	Edmondia.
Producta .	Sanguinolites.
Aviculopecten.	Cardiomorpha.
Mytilus.	Nautilus.
Myalina.	Phillipsia.

The genus *Actinocrinus* begins its existence in the upper Silurian, but attains only a feeble development until we reach the lower carboniferous. It seems to reach its culmination in the Burlington Limestone. According to a table drawn up by Dr. B. F. Shumard[125] in 1865, this genus is represented by two species in the Niagara group, 2 in the Corniferous ; 6 in the Hamilton ; 3 in the Chemung ; 115 in the Burlington Limestone ; 29 in the Archimedes Limestone, and 2 in the Kaskaskia Limestone. Later investigations render it necessary to change these figures without materially altering their ratios. It is emphatically a Carboniferous genus. Of this genus seven or eight species are known in the Marshall group; and they also belong to those peculiar types which characterize the Carboniferous limestone (Compare for instance *A. pistilliformis*).

The genus *Producta*, in its sub-generic forms, has a similar history. It begins in the lower Devonian and culminates in the Lower Carboniferous. Professor Hall describes 11 species from the Chemung group of New York. I am acquainted with 20 species (including one *Strophalosia*?), from the Marshall group. De Koninck describes 28 species from the carboniferous rocks of Belgium. D'Orbigny enumerates 63 known species of *Producta*,[126] of which one is Silurian, 4 are Devonian, and 49 are Carboniferous. Bronn enumerates[127] 45 species as certainly discriminated, of which 37 belong certainly to the Mountain Limestone, and only two occur in rocks as old as the Devonian.

Of the genus *Spiriferina* we have three species in the Marshall group. No species have ever been recognized in rocks as old as the Devonian.

The genus *Aviculopecten* is emphatically a Carboniferous type, and was so regarded by McCoy when first proposed. In his descriptions of British Paleozoic Fossils, he enumerates 18 species of the genus, 15 of which belong to the Carboniferous system, and 3 to the Old Red Sandstone. Nine species are reported from the Carboniferous rocks of Illinois. From the Marshall group I am acquainted with 12 species (including 4 species of *Pernopecten* not heretofore separated from *Aviculopecten*). It is true the Chemung contains also several species; but as the type is not known to descend lower, the presence of these species in the Chemung unites

[125] A catalogue of the Palæozoic Fossils of North America I. Echinodermata.
[126] Prodrome de Paléontologie.
[127] Index Palæontologicus.

with the presence of *Producta* and various forms of land vegetation, in imparting to that group, to this extent, a Carboniferous aspect.[128]

The genus *Mytilus*, of which we know four species in the Marshall group, is decidedly one whose history runs through later geological times. Of 203 species enumerated by D'Orbigny, only 12 are recognized as occurring in rocks older than the Carboniferous, and it is probable that some of these belong to *Modiolopsis* and *Orthonota* or allied genera.

The genus *Myalina* was established by De Koninck exclusively to receive three species from the upper part of the Coal measures of Belgium. McCoy discovered none below the Permian system. In this country the genus is restricted to the limits of the Carboniferous system, attaining its maximum development in the Coal measures. Of this Carboniferous genus the Marshall group affords at least 5 species.

Edmondia, also founded for the reception of Carboniferous forms, has not been certainly traced downwards into the limits of the Devonian system. De Koninck gives two species, both from the Coal measures; Mc Coy, in the work cited, describes 10, all of which occur in the Carboniferous Limestone. The Marshall group has afforded 9 species which have been referred to this genus.

Sanguinolites of McCoy afforded its proposer 14 species, of which 11 occur in the Carboniferous strata, and 3 in rocks of older date. In the Marshall group we recognize 19 species of this genus, including 5 belonging to the type of *Cypricardia*.

The genus *Cardiomorpha* is, in the Old World, confined exclusively to the Carboniferous System, from which De Koninck describes 13 Belgian species, and McCoy 3 British species. We have described 5 species from the Marshall group, and know of none from the Chemung.

Nine species of trilobites have been described from the Marshall group, all of which probably belong to the Carboniferous genus *Phillipsia*, though five of them were referred to *Proëtus* by their original describers. Of the latter five, *Proëtus ellipticus*, M. & W. was thought by the authors to be probably a *Phillipsia*. *Proëtus Swallowi*, Shum. is regarded as the nearest analogue of this, and the latter is hence probably also a *Phillipsia*. This species, moreover, does not present the posterior termination of the great suture required by *Proëtus*. *Proëtus Doris*, Hall, was described from pygidia, and of course its generic relations are not demonstrated. I have since discovered from the same locality, several complete cephalic shields which present the distinctive marks of *Phillipsia*, so far as they have been pointed out. All the Carboniferous trilobites of Europe and America belong to this genus and its sub-genus *Griffithides*. Though Barrande inclines to recognize Phillipsia sparingly in the upper Silurian and Devonian, we are still compelled to regard it as an eminently Carboniferous type.

[128] As has been already intimated several Carboniferous types began their existence as early as the Hamilton and even the Corniferous period. Several of the *Fenestellidæ* from the Hamilton rocks of Michigan were identified by Dr. H. A. Prout with species in the Carboniferous Limestone. His work upon these fossils was incomplete at his death, and has never been published.

Of *Nautili* we are acquainted with 13 species from the Marshall group. Of these, 11 or 12 belong to the section characterized by longitudinal furrows and angulations and an open umbilicus, for which Messrs. Meek and Worthen have proposed the sub-generic name *Trematodiscus*.

Remarks similar to the foregoing could be offered in reference to the geological affinities of various other genera represented in the Marshall group—as *Platycrinus*, *Forbesiocrinus*, *Zeacrinus*, *Pterinea*, *Posidonomya*, *Pinna*, *Macrodon*, *Solen* and certain forms of *Spirifera*, *Bellerophon*, *Orthoceras* and *Goniatites*.

Such are the leading characteristics of the fauna of the Marshall group which indicate its affinities with the Carboniferous system of Europe and America.[129] To sum up: we find 12 species identified with fossils from the Carboniferous rocks of America; 12 species which extend from the Marshall strata upwards into the base of the Burlington Limestone at a point where the two formations rest in juxtaposition; 9 species identified with fossils from the Carboniferous rocks of Europe; 32 species whose analogues recur in the higher Carboniferous rocks of America; 44 species whose analogues recur in the Carboniferous rocks of Europe; 10 generic or sub-generic forms largely represented, which characterize pre-eminently the Carboniferous system, besides numerous other genera and species whose affinities point rather to Carboniferous than to other strata.

Two years ago, (Aug. 1866,) during the meeting of the American Association at Buffalo, a discussion incidentally arose as to the paleontological relations of the Marshall group, in which on the one hand, it was claimed that it presented "a Carboniferous aspect;" while on the other hand the question was asked, "what is meant by a Carboniferous aspect?" and the remark was added: "I don't know what you call a Carboniferous aspect." I turn now to the citation of facts, of which I have just presented a summary, and reply: "That is what I mean by a Carboniferous aspect."

To answer this question in other words, let me quote the language of a distinguished American paleontologist.[130] "We have a right to contend, therefore, for the existence of the Carboniferous system at any point where we can find a continuation of the genera *Pentremites*, *Productus*, *Goniatites*, (*Cyrtoceras*, *Discites*) *Nautilus* and the ganoid fishes.[131] I contend that this is the legitimate conclusion, or else the Carboniferous system is subordinate to the Devonian." That is in principle exactly what I contend for. It was in that school, too, that I received my teaching.

VI. The Fauna of the Chemung Group presents a Devonian Aspect.

In the further prosecution of this discussion it would be appropriate to

[129] The strata of the Marshall group probably correspond to the "yellow sandstone" of Ireland and the Westphalian schists lying at the base of the Carboniferous system.

[130] Hall: Foster & Whitney's Rep. Lake Sup. Land Dist II, 308.

[131] May we not say that the Devonian is distinguished from the Silurian by the *advent* of these and other types, while the Carboniferous is characterized by their great expansion?—this being indicated by the great multiplication of species, the increased richness of ornamentation, the extravagant development of certain features, and sometimes by unusual bulk. Carboniferous types in the Devonian Age were, in a sense, *prophetic faunas*, or "colonies"—to employ a phrase from Barrande, used in reference to the Primordial Zone of the environs of Prague.

enter upon an examination of the paleontological affinities of the Chemung group, with which it has been thought this Carboniferous assemblage of strata can be synchronized. I shall content myself, however, with three remarks. 1. The fauna of the Chemung group embraces numerous generic forms, some for the first time introduced, which were destined to undergo their full expansion and find their closest analogues in the Carboniferous Age. 2. It embraces some generic and many specific forms which lingered from early Devonian times, and which do not pass the upper limits of this group. 3. The balance of affinities is universally admitted to be with the Devonian system, so that the attempt to establish that proposition would be superfluous.

VII. Can the Marshall and Chemung be Synchronized?

Ever since Cuvier first enunciated the doctrine of successive faunas in the past history of the world, geologists have held that paleontological characters stand next in importance and reliability to observed superposition in the determination of the synchronism or sequence of formations. Pictet[132] lays down the following principles for our guidance in the use of fossils:

"1. In all countries which have been studied to the present time, the geological faunas succeed each other in the same order."

"2. Contemporaneous formations, or those formed at the same epoch, contain identical fossils."

"3. Reciprocally, formations which contain identical fossils are contemporaneous."

Professor Agassiz,[133] in writing of the "succession of animals and plants in geological time," says: "I cannot refrain from expressing my wonder at the puerility of the discussions in which some geologists allow themselves still to indulge, in the face of such a vast amount of well-digested facts as our science now possesses. They have hardly yet learned to see that there exists a definite order in the succession of these innumerable extinct beings, &c."

"One result stands now unquestioned; the existence during each geological era of an assemblage of animals and plants differing essentially for each period. And by period I mean those minor sub-divisions in the successive sets or beds of rocks which constitute the stratified crust of our globe, the number of which is daily increasing as our investigations become more extensive and more precise."[134]

Professor Hall,[135] in attempting to establish the distinctness of the two groups, Portage and Chemung, uses these words: "When we apply the test of organic remains, we find an equally, or even more strongly marked difference in the two groups; and, upon this alone, a distinction between the two should be made." In reporting upon the result of his examination

[132] Paléontologie, I. p 100.
[133] Contributions to the Natural History of the U. S., vol. 1, p. 93.
[134] Ib. p. 96.
[135] Geolog. Rep. IVth Dist. N. Y., p. 229.

of western formations in 1841, he states:[135] "This examination westward also afforded a good opportunity of testing the value of fossil characters, when applied to the same strata extending over wide tracts of country, and the results will be seen, as we proceed, to have been mostly satisfactory." On another occasion he used the following words:[137] "Every step in this research tends to convince us that the succession of strata, when clearly shown, furnishes conclusive proofs of the existence of a regular sequence among the earlier organisms;" Finally, in 1850, he employed this explicit and pertinent language:[138] "In distant and disconnected localities we are compelled to base our opinions of the equivalency of beds upon the organic remains which they contain."

Such citations could be made almost without limit, but it scarcely seems necessary to proceed. Every paleontological research proceeds upon the assumption of the truths of the fundamental principles which these extracts enunciate. On paleontological grounds Professor Hall undertook the identification of the western formations; on such grounds he asserted the Spergen Hill limestone to belong to the age of the Warsaw limestone; on such grounds Mr. Billings identified the Lower Helderberg group in Maine; on such grounds Barrande divides his Promodial Zone into distinct stages which he attempts to identify in other parts of the world; on such grounds Barrande confidently asserted, without even having placed foot upon American soil, that certain Trilobites described by Professor Hall from the town of Georgia, in Vermont, belonged to a much lower stratigraphical position than had been assigned to them; and thus, while sitting in his study at Paris, confidently and successfully rectified the mistakes of field geologists in America working amongst the hills of northern New England.

It is evident that if we proceed according to the established principles of paleontological science, we shall be obliged to deny the contemporaneous origin of the rocks of the Marshall and Chemung groups. We shall be induced to leave the Chemung within the limits of the Devonian system where it has been placed by the nearly unanimous judgment of paleontologists; and to admit the Marshall group within the boundaries of the Carboniferous system according to the present nearly unanimous judgment of western geologists;[139] according to the opinions of the eminent European geologists who have investigated the question, and according also to views which were at one time shadowed forth by the present principal opponent of such views. De Verneuil[140] in alluding to certain representatives of the Marshall group, says: "As it [the Devonian system in New York] is principally composed of Schists and argillaceous sandstones which, as we have said, are lost and disappear in the West, it thence results that in the States of Ohio, Indiana and Kentucky, it is reduced to

[136] Trans. Assoc. Amer. Geol. p. 268.
[137] Paleont. N. Y., vol. I. Introd. p. XXXIII.
[138] Foster and Whitney's Rep. Lake Sup. Land Dis. II. p. 286.
[139] See the references made in the 2d section of this paper.
[140] See Amer. Jour. Soc. [2] v. 370.

the Black Schists which represent the Genesee Slate, and to a calcareous band which represents at once the Corniferous and Onondaga limestones and the Hamilton group of the State of New York."

In his comments upon this paper of de Verneuil, from which I just quoted, Professor Hall himself says:[141] "We know that *between* the Chemung group and the great Carboniferous Limestone of the West and southwest, there is an extensive formation of yellow sandstones and green shales and sandstones"—and, for the sake of enforcing a view which he then held, that even the Chemung strata ought to go into the Carboniferous system, he adds, "charged with fossils having a close analogy with those of the groups below." Still further in his tabular arrangement appended to his elaborate discussion on the "Parellelism of the Paleozoic Deposits of the United States and Europe,[142] he places the "Yellow sandstones and green shales of Ohio," not only above the Chemung, but above the shales and sandstones of the Catskill mountains."

In the presence of such facts and such testimony as have been cited, it becomes a question of curious interest upon what grounds the geological equivalency of the Chemung and Marshall can still be maintained. In a paper presented before the National Academy last summer (1867) at Hartford, and repeated before the American Association at Burlington, it was held that the Devonian fauna of the Chemung in its western extension becomes replaced by the Carboniferous fauna of the Marshall simply through the influence of *local conditions*. Geographical variations were pointed out in the nature of the deposits and the accompanying faunas, of the Trenton, Hudson River, Niagara and Hamilton groups, and it was maintained that the paleontological contrast between the Chemung and the Marshall is something of the same kind, and possessing no different significance. These views at Hartford, were endorsed by the high authority of Professor Agassiz.

The same views had been previously recorded by Professor Hall in the Fourth Volume of the Paleontology of New York,[143] as follows: "We have every reason to believe that, in those sedimentary formations between the Hamilton group and the Coal measures in the east, and between the same group and the Burlington (Carboniferous) limestone in the west, the Devonian aspect of the fauna, on the one hand, and the Carboniferous aspect on the other, are due, in a great degree, to geographical and physical conditions, and not to difference of age or chronological sequence of the beds containing the fossils."

Again, in a pamphlet "Notice"[144] of this volume, in alluding to the contrast between the faunas of the Chemung and Marshall groups, he uses these remarkable words:—"*The distinction between Devonian and Carboniferous faunas is based as often upon geographical as chronological relations.*"

[141] Amer. Jour. Sci. [2] v. 368, Note.

[142] Foster and Whitney Rep. L. Sup. Land Dis. II, Chap. xviii.

[143] pp. 252–257. See Notice of this volume, Trans. Amer. Phil. Soc., May, 1866, p. 246; also, Pamphlet, 1867.

[144] Notice of IVth volume Pal. N. Y., 1867, p. 5.

It seems to me that the doctrine asserting the influence of geographical and other physical conditions, is being carried entirely too far. That the organic beings which populated the earth in past ages must have been distributed in each period, in faunas geographically restricted, under laws identical with those which now determine the distribution of animals and plants, is a doctrine which every reflecting paleontologist has either asserted or implied.[145] It would be puerile, indeed, to attempt to draw a stratigraphical induction from paleontological data, without keeping in view the known laws of faunal circumscription. But it is a new and an unprecedented procedure for a geologist to attribute to physical conditions the characteristics which the common consent of all paleontologists has assigned to faunas which lived in different ages of the world. This is to recede to the platform of De Maillet and Lamarck; it is to yield the determination of the organic facies of a geological period to the chances of physical conditions, instead of the domination of an intelligent method of sequence and adaptation; it is to surrender the grand procession of organic forms through past time, to the moulding and determinative influence of the secular changes of the physical world; it is to turn our backs upon positions which have been so ably and so successfully defended by our great adopted naturalist; it is to drown the key-note of the celebrated "Essay on Classification" in the discord of transmutationism and materialism.

The following extract is from the celebrated paper of de Verneuil, to which allusion has so often been made:[146] "We have endeavored to prove that the first traces of organic life in countries the most remote, appear under forms nearly alike, at the base of the Silurian System; and that the same types, often the same species, are successively, and in parallel order, developed through the entire series of the paleozoic beds. If we have not succeeded in lifting the vail which still hides from us the cause of this grand phenomenon, perhaps, at least, our observations have demonstrated the insufficiency of those causes by which certain authors seek to explain it. They prove, in effect, that *the phenomenon itself is independent of the influences which the depths of seas exercise upon the distribution of animals;* for if, in certain countries, the Silurian deposits prove a deep sea, they have, on the contrary, in the State of New York, a littoral character. They prove, in fine, that, in its general character, it is equally independent of the upheavings which have affected the surface of the globe; for, from the eastern frontier of Russia even to Missouri—distant from, or near the lines of dislocation—in the horizontal beds as well as those which are disturbed, the law according to which it is accomplished appears to be uniform." "We do not pretend to say that the differences of depth in the seas had not already an influence upon the distribution of animals; it is to this circumstance, on the contrary, that we attribute the more or less local faunæ which we often discover in the paleozoic formation. *But these local faunæ always afford some species which connect them with the*

[145] See, with multitudes of others, the works of Lyell, Sharpe, Salter, de Verneuil, d'Orbigny, Pictet, and especially of Barrande and Agassiz.

[146] See Amer. Jour. Sci. [2], vii. 51.

epoch to which they belong. They are the exceptions, which do not derange the general symmetry."

Let us now examine, for a moment, the circumstances which afford a shadow of plausibility to the extraordinary dogma of the parallelism of the Chemung and Marshall groups. It is alleged first, that the fauna of the Chemung assumes gradually a less Devonian and more Carboniferous aspect, when traced westward within the limits of the State of New York, and that it is possible that the characters of the Marshall group would be reached in the prolongation of the Chemung through the Western States. This allegation must be considered in the light of the fact, that a great thickness and geographical extent of strata in eastern New York, which were, a few years since, regarded as belonging to the Catskill group, are now pronounced by Professor Hall and Col. Jewett to be really a part of the Chemung; and that strata which were formerly regarded as Chemung belong really to the Hamilton. Restoring to the Hamilton that which is its own, it cannot be otherwise than that the Chemung strata of eastern New York should present a more modern aspect than was once supposed. But let it be granted that even yet the Chemung presents a more Carboniferous aspect in western than eastern New York, it is not yet a Carboniferous fauna; it retains numerous Devonian types; it does not embrace a trio of species, if it does a single one, which reappear in central and eastern Ohio. All this is unprecedented in formations of the same age, at points but one or two hundred miles removed from each other.

In the next place, some local difference in the nature of the sediments is admitted to exist. The rocks of the Marshall group, both in Ohio and Michigan, embrace a bed which is somewhat calcareous; in southern Indiana they are known only by an aluminous limestone; in Illinois and Missouri they are, to a considerable extent, calcareous and argillaceous. On the other hand, it is notorious that the great mass of the Marshall group consists of olive, reddish and yellowish sandstones, and shaly sandstones, which can scarcely be distinguished from the strata of the Chemung. The rocks are identical, and so far as we have the means of judging, the physical conditions under which the sediments were accumulated, must have been extremely similar. We discern none of those changed conditions which are always present on the occurrence of a local fauna. And yet the two faunas are more distinct than those of the Portage and Hamilton—vastly more distinct than those of the Hudson River and Trenton groups. Such pretensions are not set up in reference to any other formation. *Lingula prima*, of the Potsdam group, is recognized in the coarse sandstones of New York and Minnesota, and the fine aluminous shales of Alabama. The western prolongation of the Hudson River group is stocked with the same *Rhynchonella increbescens*, *Orthis lynx*, *Strophomena alternata* and *Chætetes lycoperdon*, as the typical strata of eastern New York. The various physical conditions under which we find the Niagara group, present us uniformly with *Canyocrinus ornatus*, *Halysites catenularia*, *Favosites Gothlandica*, *Athyris nitida*, *Spirifera radiata*,

&c. So the Corniferous limestone holds several species which never fail to declare its identity; and the Hamilton group is traced by persistent and unmistakeable paleontological characters over an area two thousand miles in breadth—from eastern New York to the Rocky Mountains, and from Central Kentucky to the valley of Mackenzie's river. It is incredible that the fauna of the Chemung sandstones, without visible change in physical conditions, should have undergone a total transmutation in a distance less than 200 miles. Were the lithological characters of the Chemung and Marshall remarkably distinct, we should expect a marked variation in the faunas, even if contemporaneous. But we should still have detected a few identical species, and a strong correspondence in dominant ideas—as the Edmondias, Aviculopectens and Producti, of the Chouteau limestone, are identical with the same genera and species of the Marshall sandstone. In some portion of the hundreds of thousands of square miles over which the Marshall strata have been extended, would have existed physical conditions sufficiently similar to those of New York, to have permitted the introduction of a few of the types which are dominant at the East.

The facts which I have already pointed out demonstrate that there *was* a time when the fauna of Ohio and Michigan had a representation in New York and Pennsylvania. Fossils even from Iowa and Missouri—fossils from fine, and even from calcareous strata—have been identified in western New York, identified, too, in conglomeritic deposits. It is even true, as de Verneuil asserts, that there is a law, however inscrutable, which stamps a common and recognizable impress upon faunas of the same age, however diverse the physical conditions under which they subsist.

The doctrine of faunal collocations of organic beings is founded in Nature, and has been made a specialty by one whose name commands universal respect. We must apply this doctrine to the distribution of extinct animals. It seems to me, however, there is a possibility of using this doctrine as "a hobby," and of carrying it to unwarranted limits. Thinking has its fashions no less than architecture and dress. Another fashion of our times is to reunite varieties and species of organic remains, which have been discriminated often with much study and great utility. It is the fashion just now to concede a wide range to the variability of species. Both these fashions tend to a relaxation of the rigor of the limits which we had set to the influence of external agencies. It seems to me that the true philosophy leads to the practice of a judicious conservatism in reference to the long-accepted canons of paleontological science.

For these reasons I cannot, at present, consent to the parallelizing of the Chemung and Marshall groups.

VIII. Parallelism of the Catskill and Marshall.

If the Chemung be not the eastern representative of the Marshall, where, it may be asked, does that representative exist? It would be no reply to the argument which I have presented, if no representation of the Marshall were yet discovered east of Ohio. The case would not be with-

out parallel. The St. Peter's Sandstone, the Galena Limestone, the Mountain Limestone, the Laramie Limestone, are all without distinct representation at the east. The Medina Sandstone, the Oriskany Sandstone, the Schoharie Grit, and the Marcellus Shale, are without distinct representation at the west. But it seems to me that, for the Marshall group, we have discovered a probable representative in the Catskill group of New York. The lithological and paleontological facts which favor this identification have already been pointed out. If this identification be correct, it will appear that the Catskill group is not to be regarded as thinning and partially disappearing, in central and western New York, in consequence of an original lack of sediments, but in consequence of subsequent denudation upon a scale of vast magnitude.

But it may be pronounced a fatal objection to this method of paralellizing, that the Catskill is regarded by the New York geologists, and by others, as the American representative of the Old Red Sandstone, which is generally admitted to be Devonian. In reply to this, I offer two suggestions. First, it is not the universal opinion of European geologists that the Old Red Sandstone, as restricted to Scottish deposits along the flanks of the Grampians, and upon the southern borders of the Moray Firth, is properly classed with Devonian strata. The North Devon strata, to which the term Old Red Sandstone has been extended, are thought by some to hold a lower position. The Scottish Old Red Sandstone may be, in part, at least, of Carboniferous age. Secondly, the identification of the Catskill with the Old Red, rests upon the similarity of a few scales of fishes, especially of a supposed *Holoptychius*. But fish remains are quite abundant in the Marshall group, and some of them of types similar to those of the Old Red. Dr. Newberry has described three species from Illinois. Moreover, the Molluscous fauna presents numerous affiliations with the fauna of the Old Red, as delineated in Murchison's Silurian System; and this resemblance, in fact, was the first circumstance which turned my attention to the equivalency proposed in this paper. Among Marshall fossils which I have noted as having near analogues in the Old Red of Scotland, are the following:

	Analogues.
Ctenodonta Iowensis, W. & W.	Cucullæa antiqua, Sow.
Isocardia ? Jennæ, Win.	Goniophora cymbæformis.
Murchisonia quadricincta, Win.	Turritella obsoleta.
Holopella mira, Win.	" gregaria.

Finally, it may be observed, that, whether the Catskill be synchronized with the Old Red or not, it holds a position above all the typical Devonian rocks of Europe and America. Professor Hall[147] long ago stated that "after the change which takes place at the termination of the Hudson River group, there is, perhaps, nowhere else in the Paleozoic series so complete a change in the lithological and Paleozoic features of the strata as at the termination of the Chemung group. Over a considerable extent

[147] Amer. Jour. Sci., [2] v. 367, Note.

in New York and Pennsylvania, the Chemung group is succeeded by a coarse sandstone or conglomerate, which lies at the base of the Red sandstone. This change is equally great with that which took place at the production of the Oneida conglomerate, and the mass forms a distinct topographical feature in the southern part of New York, and in parts of Pennsylvania. At the same time, all the peculiar organic forms of the Chemung group have become extinct. * * * When we undertake to mark the limits between systems, at points where it is difficult to decide them either from lithological or organic characters, (as in the separation of Devonian and Silurian,) it seems to us very proper to give more importance to such a remarkable line of separation as that indicated at the base of the red sandstone. * * * The relations between the red sandstone and the Carboniferous system appear to be scarcely known at all; or whether there may, or not, be a more intimate relation between this mass and the succeeding gray sandstones, has never been shown."

M. de Verneuil,[148] while admitting it incontestible that the Catskill group "is upon the same horizon as the Old Red Sandstone of Scotland and Wales," concludes, with emphasis, that the study of the New York strata has resulted in "proving that the Old Red Sandstone, in America, is more recent than the schists and limestones which represent the deposits of the Eifel, the Hartz and of Devonshire."

In accordance with the views set forth in the foregoing paper, I append the following table of geological equivalents. The Table, as originally presented to the American Association, was published in the "Geology of Tennessee," pp. 364–5. As here given, it is slightly modified, in the Tennessee column, to adapt it to late discoveries already announced. In the Michigan column, I have merged the "Black shale" with the "Huron group," in accordance with views long entertained (see especially, Proc. Am. Phil. Soc., No. 81). That this shale occupies a position beneath the Hamilton will not, I think, be longer maintained. Whether it be wholly Genesee, or wholly Portage, or the representative of both, it is certainly a lower constituent of a group of argillaceous strata, which is one mass, physically, and which, in 1861, I was induced to designate as the "Huron Group," in consequence of its extensive outcropping around the shores of Lake Huron, between Detroit and Pt. aux Barques.

Genesee shale,	Hamilton shale.	Black Shal. (perhaps Portage in part.)	Green Shal.	(Base of Waverly Series.)						
Hamilton Gr.	Hamilton Gr.	Hamilton Gr.	Hamilton Gr.	Black Shale.						
Hamilton Gr.	Hamilton Gr.	Hamilton Gr.	Hamilton Gr.	Black Shale.						
Hamilton Gr.	Hamilton Gr.	Hamilton Gr.	Hamilton Gr.	Black Shale?						
Hamilton Gr.	Hamilton Gr.	Hamilton Gr.	Hamilton Gr.							
Hamilton Gr.	Hamilton Gr.	Hamilton Gr.	Hamilton Gr.							
Hamilton Gr.	Hamilton Gr.	Hamilton Gr.	(Wanting)	Black Shale.						
Orthoceras schiefer. Spiriferen sandstein. (Nassau.)	Black Shale.	Black Shale.								

[148] See Amer. Jour. Sci., [2] v., pp. 367, 369.

Table of Geological Equivalents.

NEW YORK.	ONTARIO.	MICHIGAN.	OHIO.	INDIANA.	ILLINOIS.	IOWA.	MISSOURI.	KENTUCKY.	TENNESSEE.	EUROPE.
(Wanting?)	(Wanting)	Parma Congl.	Conglom'ate.	Conglom'ate.	Conglom'ate.	?	?	Conglom'ate.	Conglom'ate.	Millstone Grit
(Wanting)	(Wanting)	(Wanting)	False Coal Meas.	?	False Coal Meas.	?	?	False Coal Meas.	False Coal Meas.	?
(Wanting)	(Wanting)	Carboniferous Limest. Michigan Salt Gr.	(Wanting)	(Wanting)	Kaskaskia Li.	Kaskaskia L.	?	Kaskaskia L.	Kaskaskia L.	Mountain Limest.
				St. Louis Lim.	St. Louis Lim.	St. Louis Lim.	St. Louis Lim.	St. Louis Lim.	St. Louis L.	
				Warsaw Lim.	Warsaw Lim.	Warsaw Lim.	Warsaw Lim.	?	Warsaw L.	
				Keokuk Limestone. *Gray Lim. Brown Sh. Knobstones*	Keokuk Lim.	Keokuk Lim.	Keokuk Lim.	Keokuk Lim. *Knobstones*	Keokuk L.	
				?	Burlington L.	Burlington L.	Burlington L.	?	?	
Upper part of Catskill Gr. *including "Carboniferous" Conglomerate and "Chemung" conglomer'te*	(Wanting?)	Marshall Group.	Waverly Series. *in part.*	Rockford Limest. and Williamsport Gritstone.	Kinderhook Group.	Yellow Sandstone Series.	Chouteau Limestone, Vermicular Sandst. and Shale, Lithographic Limestone.	(*Probably dark siliceous shale not yet observed.*)	Siliceous Group. Siliceous Shales.	Old Red Sand. (*Scotland.*) Yellow Sand. (*Ireland.*) Westphalian Schists.
Chemung Gr.	"Portage Shales."	Huron Group *Micaceous Schists and Flags.* *Argillaceous Shale.*	Chocolate Shale Series.	(Wanting)	(Wanting)	*Perhaps Lower part of Yellow Sandstone series.*	Bluish Shale	Argillaceous Beds.	(Wanting)	Cypridinenschiefer.
Portage Gr.										

IX. The Name.

Should the equivalencies of the rocks under consideration be finally adjusted in the manner which I have indicated, it will be important to select a designation for the group in accordance with the recognized canons of geological nomenclature. In that case, it will scarcely be permissible to employ the term "Catskill Group," since the principal mass of the rocks which are made the type of that group is now known to belong to the Chemung; and the name would be a misnomer. A similar objection rests against the use of the term "Waverly." This term, as I have already intimated, has been used in different senses; and by all parties, from Professor Briggs down, has been employed to embrace, at least in central and southern Ohio (the typical region), either the entire series of strata between the Conglomerate and the "Black Shale," or, at least, the *lower portion* of that series. It is necessary to apply a term to the exclusion of the "Chocolate Series" of Ohio, underlying the fossiliferous sandstones of the Waverly series. The first geographical designation which was employed in this restricted sense was "Marshall Group," first employed and published by me in December, 1860, and afterwards introduced in my Geological Report, advance copies of which were distributed in August, 1861.

APPENDIX.

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" Briggs: First Ann. Rep. Geol. Surv. Ohio, p. 79.
" Foster: Second Ann. Rep. Geol. Surv. Ohio, p. 105.
1839. Houghton: Second Ann. Rep. Geol. Surv. Mich., p. 28.
1840. Hubbard: Mich. Geol. Rep., p. 87.
1841. Hubbard: Mich. Geol. Rep., p. 132, &c.
1842. Hall: Am. Jour. Sci. and Arts, xlii., p. 51.
" Hall: Jour. Bos. Soc. Nat. Hist., v., p. 1.
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" Safford: Geol. Reconn. Tenn., 158.
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" Lyon: Trans. St. Louis Acad. Nat. Sci., I., 620.
" Worthen: Ib., 571.
" Swallow: Ib., 635.
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" Winchell: The Grand Traverse Region, p. 49.
" Newberry: Prospectus Neff Petroleum Co.
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" Hall: Notice of Volume IV., Paleontology of New York.
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1869. Safford: Geology of Tennessee, pp. 341, 439.
" Winchell: In Geol. of Tenn., pp. 364–5, 442–6.
" Winchell: Proc. Amer. Phil. Soc., xi., pp. 57–83.
" Newberry: Proc. Amer. Assoc. Salem Meeting, Relations of Ohio Geology to that of adjoining States.
1870. Hall: Preliminary Notice, &c., Preparatory for Palæntology of New York (received Jan).
" Winchell: Proc. Amer. Phil. Soc., xii., pp. 245–261 (read Jan. 4th).
" Newberry: Geological Survey of Ohio, its Progress in 1869. An Address before the Legislature (received 15 April).

ERRATA

IN PART I. OF THIS PAPER.

Page 57. Contents, v. for "analogies," read "analogues."
57. " ix., for "Their names," read "The Name."
64. Sixth line from top, for "*Gryroceras*," read "*Gyroceras*."
66. Tenth line from top, for "Hudson," read "Huron."
69. Note "70," line 3, for "authority," read "authorities."
72. Seventh line from top, for "correction," read "conviction."
72. Note "83," line 3. for "he previously," read "he had previously."
78. Note "104," line 2, for "geological," read "geographical."
80. Note "108," line 3, for "announcement," read "announcements."
82. Twenty-seventh line from top, for "phenomenon," read "phenomena."

Several minor errors will, perhaps, be apparent to the reader.

Remarks by Edward D. Cope, at Meeting May 6th, 1870.

Prof. E. D. Cope exhibited the nearly perfect cranium of a Dicynodont Reptile from the Cape Colony, South Africa, which he regarded as different from those described by Owen and Huxley.

The application of the cutting edges of the mandible to those of the upper jaw, was nearly horizontal instead of vertical, as in some marine Chelonia, on which account he regarded it as representing a genus distinct from Ptychognathus, with which it was otherwise identical. This was named Lystrosaurus.

It was nearest the Ptychognathus latifrons, Owen, but differed in having narrowed, sublongitudinal orbits, with immense protuberances in front of them, a very narrow front anterior to, or below these, with two parallel wide sulci on each side, and a much wider occiput and interorbital region. The middle of the cutting margin of the premaxillary was prolonged into a short beak. The front from the orbital protuberances, and the direction of the tusks, both nearly vertical. The following measurements are given:

	In.	Lines.
Length cranium (greatest),	7	9
Width occiput,	8	
" intertemporal space,	1	10.5
" interorbital "	3	7
" between supraorbital protuberances,	4	8
" anterior to orbits,	2	3
" across middle of alveolæ of tusks,	3	
" " internasal space,	1	8
" " temporal fossa,	3	1.5
Length of "	2	1.5
" from hindmost part of skull to orbit,	3	3
" from fore part of orbit to border of premaxillary,	4	9
Long diameter of orbit,	2	3
" " nostril,		11

The species was named *Lystrosaurus frontosus*. The specimen belonged to the private collection of Dr. E. R. Beadle of this city.

Portions of several large teeth or tusks enclosed in the Triassic shales and sandstones of Phœnixville, Pa., were exhibited, probably belonging to Dicynodont reptiles. They represented specimens of much larger size than that of the L. frontosus.

Sections of Strata belonging to the "Bear River Group," near Bear River City, Wyoming Territory.

By F. V. Hayden, M. D.

Read May 6, 1870.

During my explorations along the line of the Union Pacific Railroad, last autumn, my attention was attracted by two of the most remarkable artificial cuts or excavations that I have ever seen in the West. They are located about a mile west of Bear River City, or nearly 950 miles west of Omaha. No such exhibitions of the strata can be found in the country, formed by natural causes. Usually the rocks of the modern formations are composed of such soft materials that they have readily decomposed on the surface, covering it with a considerable thickness of debris, thus concealing, in many instances, not only the true character of the underlying rocks, but also many of the details of the stratification.

At my request, Mr. H. R. Durkee, an excellent civil engineer, residing at Bear River City, made a careful survey of the cuts, and noted the character of each layer, with its thickness in feet and inches. Some of the layers are so crowded with fresh water shells that they seem almost made up of them. A list of them is given in Mr. Meek's Catalogue.

Upon the surrounding hills, among the debris rock from these beds, the fossil shells are so abundant that they may be gathered by the bushel, like nuts in autumn, in a fine state of preservation. The strata are all regarded as of lower Tertiary age, and belong to what I have denominated the Bear River Group. All the beds in this vicinity are very much disturbed, holding a nearly vertical position, or inclining at a high angle. I desire to call the attention of scientific men to these sections as they travel along this portion of the road, and for that reason I regard them of some value. I shall hereafter work up the geology of this district more in detail, and simply wish to make a record of these facts at the present time.

Commencing at the Eastern Extremity of the Cut.

No.	Description.	Feet.	In.
1.	Clay, Greyish, Black, contains fragments of sandstone,	10	
2.	Limestone, Blue,	2	
3.	Clay, Greyish-black,		6
4.	Clay, Brown, hard, and in large fragments,	1	
5.	Clay, Black, " " small "	1	
6.	Limestone, Blue, Fossiliferous,	1	6
7.	Clay, Greyish-black,	1	2
8.	Sandstone, Fragmentary,		2
9.	Clay shale, Grey,	1	
10.	Clay, Greyish-black, very compact,	1	
11.	Clay shale, Black,		10
12.	Marl, shells in fragments,		8
13.	Clay shale, Black,		6
14.	Limestone, much shattered, and in angular pieces,	2	

No.	Description.	Feet.	In.
15.	Clay shale, Black,		10
16.	Limestone, angular fragments,		6
17.	Clay shale, Brown,		
18.	Limestone, slightly fossiliferous,	1	6
19.	Gypseous Earth, contains crystals of Selenite,		3
20.	White Marl, shells fragmentary,	1	
21.	Limestone, very fossiliferous,		6
22.	Clay shale, Black,	1	4
23.	Limestone, very fossiliferous,		2
24.	Clay shale, Brown,	2	6
25.	Sandstone, Fragmentary,	4	
26.	Clay shale, Grey-black,	2	
27.	Gypseous earth, layer of crystals of Selenite on E. side,		6
28.	Clay shale, contains streak of coal and Gypseous earth,	2	6
29.	Gypseous earth, contains streaks of brown bituminous shale,		8
30.	Clay shale, Brown, very hard,	1	6
31.	" Black, Bituminous,		5
32.	Marl, Grey,		2
33.	Limestone,		10
34.	Clay, full of fossils,		3
35.	Clay shale, Grey,	1	
36.	" Blue,		3
37.	Sand. Yellow,		2
38.	Clay shale, Grey,	1	
39.	" " Bituminous,		8
40.	Limestone, Fossiliferous,		6
41.	Clay shale and marl, Fossiliferous, less foss. on W. side,	1	6
42.	Bituminous shale, contains streaks black coal,		4
43.	Clay shale, Blue,		6
44.	Gypseous Earth,		1½
45.	Clay shale, Blue,		1
46.	Marl,		4
47.	Clay shale, Blue,	1	
48.	Marl, Yellowish-white,		3
49.	Sandstone, Fossiliferous,		9
50.	Clay shale, Blue,	1	2
51.	Sandstone, Fragmentary,		8
52.	Clay shale, Blue and Yellow,		6
53.	Limestone, very fossiliferous,		6
54.	Clay, full of fossils,		2
55.	Bands, Black, bituminous shale and marl,	2	6
66.	Marl,		5
57.	Slaty shale, Black,		6
58.	Limestone, very fossiliferous,		3

No.	Description.	Feet.	In.
59.	Slaty shale, Grey,		10
60.	Shale, full of fossils,	1	
61.	Clay shale, Black,		8
62.	" Yellowish-brown,		6
63.	" Blue,		6
64.	Coal and yellow shale in streaks,		10
65.	Limestone, very fossiliferous,	1	
66.	Marl,	1	
67.	Limestone, slightly foss., fossils fragmentary,	1	6
68.	Nodular clay and shells, streaks bituminous shale on W. side,		10
69.	Marl, Yellow, hard,		4
70.	Marl, Black, soft,		5
71.	Clay shale, Black bituminous,	1	6
72.	Gypseous earth, yellow and white,		2½
73.	Marl, hard,		4
74.	" soft,		8
75.	Clay shale, Grey,	1	
76.	Clay and shale in bands,	1	
77.	Marl,	2	
78.	Gypseous earth, Yellow,		1
79.	Marl,	2	6
80.	Clay shale, Black and Blue, in bands,	4	
81.	Clay, stony, Grey,	2	
82.	Gypseous earth, Yellow,		3
83.	Limestone, fossiliferous, fossils small,	1	8
84.	Gypseous earth, white,		2
85.	Clay, stony, Bluish-gray,	2	6
86.	Clay shale, Black,		10
87.	Limestone fossiliferous,		8
88.	Clay shale, Black,		3
89.	Limestone,		4
90.	Marly clay, Black,		2
91.	Marl, Light grey,		2½
92.	Clay shale, "		4
93.	" Black,		4
94.	" Grey,		6
95.	" Black,		2
96.	Gypseous earth, Yellow,		2
97.	Clay shale, Black,		4
98.	Gypseous earth, Yellow,		3½
99.	Limestone,	1	6
100.	Clay shale, Blue,	1	
101.	Limestone.		8
102.	Clay shale, Blue,		8
103.	Limestone,	1	8

No.	Description.	Feet.	In.
104.	Marl, Grey,		6
105.	Shale, Black,		2
106.	Sandstone,		3½
107.	Marl,		3
108.	Shale, Black,		4
109.	Marl,	2	
110.	Shale, Bituminous,		1
111.	Marl,		2
112.	Limestone,		8
113.	Marl,		5
114.	Limestone,		6
115.	Marl,	1	
116.	Shale, Black,	1	
117.	Coal and Shale,		2
118.	Limestone,		11
118.	Marl,		6
120.	Limestone,		10
121.	Marl,	1	6
122.	Clay shale, variegated (Purple, Yellow, &c.)		9
123.	Limestone, slightly fossiliferous,		3
124.	Gypseous earth,		6
125.	Limestone, slightly fossiliferous,		4
136.	Marl, Bluish-black, hard,		2
127.	Coal,		¼
128.	Gypseous earth,		3
129.	Coal,		¼
130.	Limestone,	1	
131.	Marl and coal,		2
132.	Limestone,		7
133.	Shale, Bituminous, Black,		10
134.	Marl, hard,		4
135.	Shale, Black,		1
136.	Marl.	2	
137.	Shale,		1
138.	Limestone, very fossiliferous,		4
139.	Clay shale, Blue, full of fossils,	1	
140.	Shale, Bituminous, Yellow and Black,		3
141.	Limestone,	2	6
142.	Shale, Slaty, Black,		6
143.	" Brown, full of fossils,		3
144.	" Blue,		7
145.	Marl,		3½
146.	Gypseous earth,		1
147.	Limestone, compact, streaks of marl and coal, which run out,	3	6
148.	Shale, Slaty,	1	2

No.	Description.	Feet.	In.
149.	Bituminous shale and Brown coal,		8
150.	Limestone,	1	
151.	Clay shale, contains scales of white Gypseous earth,	1	10
152.	Marl, hard,		3
153.	Shale, fossiliferous,	2	
154.	Clay, hard, fossiliferous,		8
155.	Clay shale, Black,		1½
156.	Clay, hard, fossiliferous,		4
157.	Marl, Grey,		6
158.	" Black,		2
159.	Gypseous earth, White,		8
160.	Clay, hard,		8
161.	Marl,		1
162.	Coal, Brown,		6
163.	Clay,		2
164.	Limestone,	3	
165.	Gypseous earth and shale,	2	
166.	Limestone,	1	6
167.	Sandstone, Yellow,		2
168.	Limestone,	1	
169.	Gypseous earth and shale,		8
170.	Limestone,	1	
171.	Clay shale,	3	
172.	Bituminous shale,		4
173.	Limestone,	2	

From No. 173 to western end of cut (which is made up of the reversed strata, but not in regular order, some seem to be pinched out).

ORDER OF STRATA EXPOSED IN RAILROAD CUT NO. 2.

(FROM EAST TO WEST.)

No.		Feet.
1.	Drift, steel colored,	15
2.	Sandstone, White,	12
3.	" Yellow, containing fragments, No. 2,	1.5
4.	Shale, arenaceous, Brown,	9.5
5.	Sandstone, coarse, yellow, in layers,	1
6.	" fine, " in thin layers,	1.5
7.	" coarse, containing irregular streaks of brown shale, which contains coal in fragments,	2.5
8.	" fine, white,	18
9.	" brown, contains brown marks resembling bark and branches,	.25
10.	" Steel grey, contains streaks of No. 9,	40
11.	Shale, Black, and sandstone, steel grey,	1
12.	Sandstone, Fine, white,	4
13.	" in thin layers of variegated colors,	6
14.	" in broad " "	21

Ne.		Feet.
15.	Sandstone, steel grey,	12
16.	" in thin layers of variegated colors,	5
17.	" steel grey, in layers (contains streaks of coarser yellow in layers),	35
18.	Shale, Brown,	2
19.	Sandstone, Yellow,	6
20.	Shale, Brown,	1
21.	Sandstone, Steel grey,	40
22.	" White,	6
23.	Sandstone, Grey,	4
24.	Shale, earthy, Black,	1
25.	Gypseous earth, Yellow,	.5
26.	Shale, Black,	.5
27.	Sandstone, contains shells in fragments,	15
28.	Shale, Brown,	1
29.	Clay, marly,	1.5
30.	Sandstone, Yellow,	30
31.	Shales and clays, earthy,	25
32.	Shale, Brown,	6
33.	Sandstone and Gypseous earth,	20
34.	Shale, Bituminous,	1
35.	Gypseous earth,	3
36.	Sandstone, yellow,	10
37.	" white,	8
38.	Marl, contains shells,	6
39.	Gypseous earth,	2
To end of Cut, Shale, clay, and arenaceous Gypseous earth,		60

Length of cut, 440 feet.

A Preliminary List of Fossils, collected by Dr. Hayden in Colorado, New Mexico and California, with Brief Descriptions of a few of the New Species.

By F. B. Meek.

Read before the American Philosophical Society, May 6, 1870.

Silurian Species.

Camp Creek Cañon, Colorado City.

1. *Orthis Coloradoensis,* Meek.

A small, compressed, nearly equivalve, subsemicircul species, much widest on the hinge line, which is sometimes abruptly produced into lateral auricles. Dorsal valve less convex than the other, and having a shallow, rather wide, mesial sinus, rapidly narrowing to the beak, which does not project beyond the hinge line. Ventral valve depressed convex, with cardinal area rather low, flat, inclined backward, and sharply defined to

the lateral extremities; beak not incurved. Surface of both valves ornamented with sharply defined, slightly curved, unequal radiating plications, and finer unequal striæ, which, on the central regions of the valves, are more or less gathered into five or six fascicles, the middle one of which corresponds to the sinus in the other valve.

In its surface markings and sinuous dorsal valve, this species is much like a form from the upper Lingula-flags of Wales, referred by Mr. Davidson, doubtfully, to *O. lenticularis*, Wahlenberg. It is much more extended on the hinge line, however, and has the radiating costæ and striæ more strongly defined on the central region, and more nearly obsolete on each side. From its affinities, it seems to be a Lower Silurian species, but as no other fossils were found with it, its exact age may be somewhat doubtful. It is unlike any Devonian or Carboniferous form known to me.

Crater's Falls.

2. *Merista?* (undetermined).
3. *Ophileta complanata*, Vanuxem, or a very closely allied species.
4. *Bucanella nana*, Meek.

Very small, and much like *Bucania trilobatus*, Hall, but much smaller, with proportionally larger umbilicus, and its three or four volutions increasing less rapidly in breadth, both transversely and in the direction of the plane of the shell; while its middle lobe is proportionally narrower, and embraced by each succeeding turn.

As these little shells want the remarkable expansion of the aperture characterising *Bucania*, and show no traces of the mesial dorsal band, corresponding to a dorsal sinus in the lip; as in *Bellerophon*, they seem to me to belong to an undescribed genus, for which I would propose the name *Bucanella*.

5. *Pleurotomaria?* or *Raphistoma*. Merely indeterminable lenticular casts.
6. *Endoceras*. Small undt. sp.

CARBONIFEROUS SPECIES.

Moleen Station.

1. *Fusulina cylindrica*, Fischer?
2. *Syringopora* (undetermined).
3. *Campophyllum*, like *C. torquium*, Owen, sp. From the Upper Coal Measure, along the Missouri, at Rock Bluff, and near there in Nebraska and Iowa.
4. *Chaetetes* (undt. massive sp).
5. *Productus Nebrascensis*, Owen.
6. *Spirifer* (*Martinia*) like *S. planoconvexus*, Shumard.
7. *Bellerophon?*; a rude cast; may be a *Nautilus* or *Goniatite*, as it is not in a condition to show septa, if any exist.

Sangre de Christo Pass, South Colorado.

8. *Productus semireticulatus*, Mart. (sp.)
9. *Productus punctatus*, Martin, sp.
10. *Athyris subtilita*, Hall (sp).

Pecos Church, New Mexico.

11. Fragments crinoid columns.
12. " *Spiriferina.*
13. *Spirifer cameratus*, Morton (fragments).
14. *Productus.* Fragments, like *P. semiretuculatus.*

Near Pecos R. N. M., Aug. 6, 1869.

15. *Fenestella and Polypora.* Fragments.
16. *Athyris subtilita*, Hall?
17. *Aviculopecten* (undt).
18. *Aviculopecten occidentalis.* Shumard.
19. *Aviculopecten carbonarius*, Stevens?
20. *Myalina Swallovi*, McChesney.
21. *Myalina subquadrata*, Shumard.
22. *Myalina perattenuata*, M. & H.
23. *Pleurophorus?* (undetermined).

Ten miles South of Kosylowiski, New Mexico.

24. *Fenestella* (undt).
25. *Athyris subtilita*, Hall.
26. *Spiriferina Kentuckensis*, Shumard.
27. *Myalina Swallowi*, McChesney.
28. *Myalina* (undetermined).
29. *Avicula* (fragments).
30. *Pleurophorus angulatus*, M. & W.
31. *Pleurotomaria?* (large cast).

Mora Creek, New Mexico.

32. Crinoid columns.
33. *Productus nodosus*, Newberry.
34. *Athyris subtilita*, Hall, sp.
35. *Spiriferina Kentuckensis*, Shumard.
36. *Spirifer Rocky-montana*, Marcou.
37. *Spirifer comeratus*, Morton.

Mora River, (*1st ser. Carb.*)

38. *Polypora, Fenestella, &c.*
39. *Synocladia* (*Septopora*) *Cestriensis*, Prout, sp.(=*S. biserialis*, Swallow.)
40. *Productus semireticulatus*, Mart. (may be, in part, *var.* of *P. costatus*),
41. *Productus nodosus*, Newb.
42. *Athyris subtilita*, Hall (sp).
43. *Spiriferina Kentuckensis*, Shumard.
44. *Spirifer cameratus*, Morton.
45. *Orthoceras* (fragment).

Hot Springs, Salinas Creek, (Sept. 3d).

46. *Campophyllum?*
47. Crinoid columns.
48. *Chætetes*, undetermined; both massive and ramose.
49. *Productus longispinus*, Sow. (var. *Wabashensis*, N. & P.)
50. *Productus nodosus*, Newb.

Santa Fe, New Mexico.

51. *Hemipronites crassus*, M. & H.
52. *Productus longispinus*, Sow.
53. *Productus semireticulatus*, Martin, sp.
54. *Productus nodosus*, Newb.
55. *Productus*, (undetermined, 2 or more sp.)
56. *Productus Nebrascensis*, Owen.
57. *Orthis* (undetermined).
58. *Chonetes* (undetermined).
59. *Athyris subtilita*, Hall (sp).
60. *Spirifer cameratus*, Morton.
61. *Spirifer Rocky-montana*, Marcou.
62. *Spiriferina Kentuckensis*, Shumard.

Morav. City, Weben Mt.

63. *Productus semireticulatus*, Martin, sp.

Salt Lake.

64. *Campophyllum.* Mere fragments in hard, bluish-gray limestone.

NOTE.—It is worthy of note that, although some of the species mentioned in the foregoing list of Carboniferous fossils, are forms known to be common to the Lower Carboniferous and the Coal Measures of the Western States, they are *all*, with one or two exceptions, so far as they have been identified, forms common in the Coal-measures of Illinois, Iowa, Kansas and Nebraska; while *not a single one of them* is identical with any of the species *peculiar* to the Carboniferous limestone series below the horizon of the Milistone-grit in the Western States, though about 14 of them seem to be peculiar to the Coal-measures there.

JURASSIC SPECIES.

Salinas Creek.—Hot Springs.

1. *Cardinia?* (undetermined).
2. *Pholadomya* (undt).

} Very poor specimens, not showing hinge. Look like some Jurassic forms, but only referred provisionally to that epoch.

Between Sacramento and Summit Station.

3. Undt. bivalve.
4. " univalves, 2 forms.
5. *Ammonites Nevadensis*, Gabb.

These fragments belong to the group of discoid Liasic species, with keeled and bisulcated periphery, and numerous very slender whorls, all exposed on each side, and crossed by nearly or quite straight, simple, smooth, regularly arranged costæ. They belong to one or the other of Mr. Hyatt's genera—*Discoceras*, *Arnioceras*, or *Ophioceras*. Very probably of Liasic age.

Weber Cañon.

6. *Bivalves.* Mere undeterminable casts, in a matrix like that of beds in the west, of Jurassic age.

Camo. (C. L. Morcham.)

7. *Belemnites densus*, M. & H.

CRETACEOUS SPECIES.

Fountain Creek, Colorado City, Colorado.

1. *Inoceramus* (undt. sp.) Cret. No. 4
2. *Baculites compressus*, Say. "
3. *Baculites ovatus*, Say. "
4. *Scaphites Cheyennensis*, Owen. "
5. *Scaphites nodosus*, Owen. "
6. *Scaphites Conradi*, Morton.[1] " 5
7. *Ammonites placenta*, De Kay.[2] " 4
8. *Inoceramus problematicus*, Schlot. (sp.) " 3
9. *Ostrea congesta*, Conrad. "
10. *Inoceramus* (undt. large gibbous distorted sp.) "
11. *Ammonites* (undt.) " 2 or 3

Miser Station, U. P. R. R., Oct. 19th.

12. *Inoceramus* (undt.) Cret. No. 4.
13. *Baculites ovatus*, Say. "

Near Canon City.

14. *Bivalve* (undt. sp.) Cret. No. 4
15. *Baculites ovatus*, Say. "

Medicine Bow Station.

16. *Inoceramus* (undt). Large sp. No. 4 Cret.

Mission Station, N. P. R. R.

17. *Inoceramus* (undt. sp). Cret. No. 4.
18. *Ammonites* (undt).
19. *Caprina* (undt).

Between Denver and Cheyenne.

20. *Inoceramus* (large undt. sp).

Six miles east of Como Station, U. P. R. R.

21. *Inoceramus* (undt. sp).

Valley of Fountain Creek, Colorado.

22. *Anisomyon* (undt. sp). No. 4 Cret.

Red. Between Hard Scrabble and St. Charles.

23. *Inoceramus problematicus*, Schlot. (sp). Cret No. 3.
24. *Ostrea congesta*, Conrad. " "

Medicine Bow River.

25. *Inoceramus fragilis*, Hall and Meek. No. 2 Cret.
26. *Scaphites Warrenana*, M. & W. " "
27. *Ammonites serrato-carinatus*, Meek. Cret. No. 2.

Shell attaining a rather large size; discoid, with periphery provided with a very narrow, prominent, serrated mesial keel, including the siphuncle. Volutions increasing rather gradually in size, somewhat com-

[1] I propose for the group of *Scaphites*, of which this may be regarded as the type, the subgeneric name, *Discoscaphites*.

[2] This may be regarded as the type of a group, for which I propose the name *Placentoceras*.

pressed laterally, and a little excavated, without being distinctly channeled on each side of the ventral keel; inner ones but slightly embraced by each succeeding turn, and consequently well exposed in the wide umbilicus. Surface ornamented with numerous unequal costæ, some of the larger of which bear a small, somewhat pinched node near the umbilicus, and two closely approximated small nodes around the ventro-lateral margins, where they all curve very strongly forward as they pass upon the periphery; spaces between each two of the large nodose costæ, occupied by from one to about three smaller ones. Septa unknown.

Although undoubtedly a Cretaceous species, this shell would rather nearly resemble *A. spinulatus*, Brug., from the Lias, as illustrated by d'Orbigny, if that species had from one to three smaller costæ between each two of its ribs, and its serrated keel more prominent. Our shell also differs in the presence of a small node near the umbilicus, on each of the larger costæ. It is not a true *Ammonite*, according to the latest classification of the *Ammonitidæ*.

Fort Bascom.

28. *Gryphæa navia*, Conrad. Cret. No. 2 or 3.

Dodson's Ranche.

29. *Inoceramus problematicus*, Schloth. (sp.) Cret. No. 2.
30. *Cucullæa*, and other undt. bivalves. " "
31. *Anchura*, undt. " "

Como—(C. L. Morchom).

32. *Baculites ovatus*, Say.

Near Coalville, in high hill, and near base of same.

33. *Ostrea* (undt. sp.)
34. *Modiola Pedernalis*, Rœmn.
35. *Nuculana.*
36. *Pleurotomaria* ? ?

TERTIARY SPECIES.

Associated with Coal-bed, Bear River City.

1. *Ostrea soleniscus*, Meek.

Attaining a length of near one foot, and very narrow, or not more than from one to two inches in breadth; almost perfectly straight, excepting the immediate beaks, which usually curve a little to the left; sides nearly straight and parallel. Upper valve flat; lower moderately concave, and like a little trough. Surface of both valves without radiating striæ or costæ, or strong concentric markings. May be Cretaceous.

Limestone-hill, Bear River.

2. *Unio vetustus*, Meek.
3. *Unio belliplicatus*, Meek.

Differs from the last in having the posterior dorsal region marked with about six to eight strong, regular, oblique plications, which begin very small and crowded, just in front of the beaks, and radiate backward and downward nearly to the posterior and postero-basal margins.

4. *Corbula* (*Azara*) *pyriformis*, Meek.
5. " " " var. *concentrica*, Meek.
6. " " *Engelmanni*, Meek.
7. *Cyrena* (*Corbicula*) *Durkeei*, Meek.

Shell attaining a moderately large size; subtrigonal in outline, thick and strong, gibbous in the central and umbonal regions, and cuneate postero-ventrally; posterior side sloping above, and narrowly rounded below; beaks rather elevated, pointed, and curving inward and forward, so as nearly to touch each other; posterior dorsal region much inflected from the beaks down the slope nearly to the extremity of the valves, so as to give the posterior umbonal slopes a prominently rounded appearance. Surface with moderately distinct marks of growth.

Very closely allied to *C. antiqua*, Ferr., and *C. Forbesi*, Desh., from Lignite Lower Eocene beds of the Paris Basin, but differs from both in the details of the hinge, its lateral teeth being nearly or quite smooth, and like the cardinal teeth, differing in other respects.

Named in honor of Mr. H. R. Durkee, who sent large collections of the species to the Smithsonian Institution, from Wyoming.

8. *Tiara humerosa*, Meek.

Elk Station, Cent. Pac. R. R., beyond Salt Lake.

9. *Sphærium* (two or more species, in highly bituminous shale).

Fort Bridger; Wyoming (McCarter).

Unio Haydeni, Meek.
Melania (*Goniobasis?*) *Simpsoni*, Meek.
Viviparus (two or more undt. species).
Planorbis spectabiles, Meek.
Cypris (undt.) In Oolitic? matrix.

DESCRIPTIONS OF FOSSIL FISHES, FROM THE UPPER COAL MEASURES OF NEBRASKA.

By Orestes St. John.

Read by Dr. F. V. Hayden, before the American Philosophical Society, May 6, 1870.

Genus CLADODUS, Agassiz.

Cladodus mortifer, N. and W.

Reference.—Newberry and Worthen, Geol. Illinois, Vol. II, p. 22; Pl. I, fig. 5.

In the collection there are fragments of three individuals of the above species—two showing the base with portions of the crown, and one preserving about a third of the lower portion of the median cusp of a very large specimen. There can be no doubt that the teeth before me are referable to the above species; but as they exhibit characters not shown in the imperfect specimen figured and described by Messrs. Newberry and Worthen, a short description of the Nebraska teeth is here appended.

Description.—The base of the tooth is semi-elliptical in outline, obtusely angular behind, with low protuberances rising at the angles upon the superior inner margin, the outer margin interrupted by a broad, shallow sinus, at either angle of which, immediately beneath the smaller lateral denticles, an obtuse node projects downward, similar to those upon the upper opposite side of the root, the presence of which would seem to have been designed to lend additional strength to the muscular attachment of the tooth upon its cartilaginous support; median cone cervical, regularly tapering, recurved, inequally compressed, with acute lateral edges; striæ sharp, interrupted, separated by wide plane spaces, less numerous upon the strongly compressed anterior face, and confined to the lower half of the cusp; lateral denticles two upon either side, strong, with sharp cutting edges, and strong sharp striæ or ridges.

Breadth of base twice its length, and equal to the entire height of the tooth.

This species, so far as we at present know, is restricted to the Upper Coal Measures. The single type specimen from which the species was originally described, was found in the Upper Coal strata near Springfield, Illinois; and in the prosecution of the geological survey of Iowa, Dr. White has brought to light the same species from the Upper Coal Measures of the southwestern portion of the State. I have also found this species in the same formation at Manhattan, Kansas.

Compared with other species, the present one is probably more closely related to *C. mirabilis*, Agassiz, from the mountain limestone, Ireland, than with any other with which I am acquainted. It differs, however, in being less robust, and more symmetrical in its general proportions.

Formation and Locality:—Upper Coal Measures, bed 6, Nebraska City section, Nebraska.

Genus DIPLODUS, Agassiz.

Diplodus compressus, Newb.

Reference.—Newberry, Geol. Illinois, Vol. II, p. 60; Pl. IV, fig. 2.

The single specimen *Diplodus* in the collection is probably referable to the form described by Dr. Newberry, under the name *D. compressus*.

Description.—The tooth is of medium size; base slightly narrower than long, broadly rounded in front, and terminating in an obtuse point behind, under surface slightly raised in the middle, anterior extremity produced into a large obtuse tubercle projecting slightly outward and downward, with a flattened, sharply defined, obovate pad-like projection upon the upper surface of the posterior extremity, marked upon either side by a shallow groove terminating above in a little pit, and which is entirely separated from the bases of the crown cusps,—in this latter respect, as Dr. Newberry has remarked, offering marked contrast to *D. gibbosus*, Agassiz, from the mountain limestone of Europe; cusps three, median one rudimentary, slender, compressed, with finely crenulated lateral edges, base well defined from the general surface and terminating in a slight protuberance in the osseous root in front; the apices of the lateral cusps

are broken away in the specimen before me; they are strongly compressed, smooth, with sharp, beautifully annulated cutting edges, unequally divergent; left one—viewed from before—most inclined from a vertical line and broadest at base; transverse section of both lenticular.

In the collection of the State Geological Survey there is a tooth from the Upper Coal Measures of southwestern Iowa, which is doubtless specifically identical with the Nebraska specimen, though possessing some slight differences. In the Iowa specimen the base has, as in the above described tooth, a lozenge-shaped outline, its posterior extremity is more abruptly truncated, and the pad-like elevation surmounting its surface is ellipitical with its longer axis transverse to the root—in other respects the same as the Nebraska tooth; viewed in front, the right lateral cone is the strongest and most inclined laterally, and the bases on the anterior face are swelled out, producing an angular ridge or buttress, which, however, is lost both in the crown above and in the root below. These two individuals are the only ones I have had opportunity to examine, and comparing them with the excellent description and figures of *D. latus*, Newb., I cannot doubt but that they are distinct from that species. The present species is described from the Coal Measures of Ohio and southwestern Indiana, the latter locality holding a stratigraphical position probably below the Nebraska horizon.

Form. and Loc.—Upper Coal Measures.

GENUS PETALODUS, Agassiz.

PETALODUS DESTRUCTOR, N. and W.

Reference.—Newberry and Worthen, Geol. Illinois, Vol. II, p. 35; Pl. II, figs. 1-3.

The collection contains a large, almost perfect specimen of the above species, which presents the following characters:

Description.—The crown is sharp, compressed, gradually thickening toward the base; crest more or less gently arched from the lateral extremities, obtusely acuminate at the apex, and distinctly striated for the space of a line or less, below which the striæ are lost in the dense enamel-like coating which covers both faces of the crown; posterior face of crown rhombic, outline of base similar to that of crest, and bordered by five strongly marked imbricating folds, which are conspicuously arched downwards in the middle and more or less deflected at the lateral extremities; anterior face broadly rhomboidal, basal fold consisting of four or five obscurely marked imbrications, gently curved downwards in the middle and again at the lateral extremities; the upper edges of the imbricating folds are minutely crenulated; root broad, compressed at the edges, rapidly tapering from the lateral shoulders, and terminating in a blunt rounded point. Upon much worn surfaces the crown is finely punctate.

	Inches.
Length, nearly	2
Greatest breadth of crown, about	1.60
Height of anterior face of crown,	.95
Height of posterior face,	1.28
Breadth of root across the lateral shoulders, about	1.1

This species bears a striking resemblance to *Petalodus acuminatus*, Agassiz, from the mountain limestone of Europe; but, at the same time, it possesses characters which readily distinguish it from that species. The present species differs mainly in the more tapering root, the coronal band upon the inner face is more strongly curved downwards in the middle, and the crown is relatively higher. This species was originally described from the Upper Coal Measures of central Illinois. I have seen a fine specimen of the same species in the collections of the Museum at Cambridge, from similar horizons in southwestern Indiana, and also from the Upper Coal Measures of central Iowa.

Form. and Loc.—Upper Coal Measures.

GENUS PERIPRISTIS, Agassiz (MS).

Gen. char.—Teeth small or of medium size, possessing the general characteristics of the Petalodonts. Crown compressed, acuminate, serrate, more or less curved laterally; extremities on the inner face connected by a raised transverse shoulder, in which the crown terminates below and which gives rise to a more or less profound coronal cavity. Root well developed, entire, as in *Petalodus*. The surfaces of the crown and coronal cavity are covered by a dense and highly polished layer of ganoine, which forms an imbricated band at the base.

The above generic designation was suggested by Prof. Agassiz, for the reception of a group of peculiar teeth, of which we have at least two representative species—that of *P. semicircularis* being regarded as the type. These forms certainly possess features which are widely at variance to the typical species of the genus *Ctenoptychius*, as represented by *C. apicalis*, Agassiz; and in their description of the following species, Messrs. Newberry and Worthen have also referred to the remarkable characters which distinguish it from the typical species of *Ctenoptychius*. The central coronal cavity and the prominent transverse ridge in which the root is terminated above on the posterior aspect, are peculiarities which do not appear in any of the numerous other genera comprised in the groups of Petalodonts.

The genus is Carboniferous, ranging from the Subcarboniferous to the Upper Coal Measures inclusive.

PERIPRISTIS SEMICIRCULARIS.

Ref. and Syn.—*Ctenoptychius semicircularis*, Newberry and Worthen, Geol. Illinois, Vol. II, p. 72; Pl. IV, Figs. 18, 18a, 18b.

Description.—Tooth small, broadly obovate in outline, crown much compressed and strongly curved laterally, giving the crest a semicircular outline viewed from above; cutting edge divided into seven to nine denticulations, the median lobe strongest, lateral ones gradually decreasing in size toward the lateral extremities, where they are scarcely relieved from the edge; the calcigerous tubes slightly diverge on nearing the edge, producing a minute radiated striation of the denticulations like that observed in the even crest of *Petalodus*, and when the crown is much worn the surface is finely punctate; outer face of crown very low in proportion to

its breadth, base sharply beveled, coronal band narrow, imbrications very obscure or obsolete, gently descending in the middle and slightly curved downward at the lateral extremities; upon the posterior face the base of the crown is defined by a conspicuous transverse ridge, which unites the lateral extremities, and gives origin to a deep central coronal cavity; the enamel-like coating lines the walls of the cavity, and spreading over the gently and regularly downward arched transverse shoulder, it forms a thin coronal band with one or two faint imbrications upon its external inflexed border. The root is nearly as wide and much thicker than the crown, tapering rapidly and rounded at its extremity; anterior side convex or ridged, posterior face slightly concave transversely, both surfaces more or roughened.

	Inches.
Greatest length,	.77
Greatest breadth at the lateral angles of the crown,	.72
Height of crown upon its anterior face,	.32
Depth of the coronal cavity from the apex of the median denticulation, about	.45
And from the transverse shoulder, about	.20

The collection contains a perfect individual of the above described species, from Bellvue, Nebraska, imbedded in a matrix of limestone, but exhibiting the entire posterior aspect of the tooth without a blemish; and I owe to the kindness of Mr. J. Sterling Morton, of Nebraska City, another equally perfect specimen, obtained from a shaft excavation near the City, which shows the anterior face of the tooth. I think there can be no question as to their specific identity with the form described by Messrs. Newberry and Worthen, from the Upper Coal Measures of Illinois.

I am acquainted with but a single other form to which this species seems to be closely related, and that is from the mountain limestone of Yorkshire, England. Specimens of the latter species are in the extensive collections of the Museum of Comparative Zoölogy at Cambridge. The English specimens are, however, markedly specifically distinct from the American; they are less curved laterally, and possess some sharp, thick serrations on either side of the median cusp; the crown is relatively higher, and the coronal band on the outer face is more deeply arched downward in the middle, is wider and more distinctly imbricated; the coronal cavity of the inner face is shallower, and the transverse shoulder less prominent. I am not aware that the English species is described.

Form. and Loc.—Upper Coal Measures.

Genus CHOMATODUS, Agassiz.

Chomatodus arcuatus, n. sp.

A fragment of limestone from Bennet's mill, near Nebraska City, preserves the impression of a tooth of the genus Chomatodus, which seems to be distinct from all the species of this genus heretofore described from the Coal Measures and Subcarboniferous. The impression presents almost the entire figure of the anterior face, from which the following description is given:

Description.—Tooth large, laterally elongated, moderately thick (?), extremities rounded; crown slightly arching from the lateral angles and curved laterally, anterior face slightly convex vertically and rounded at the crest, which was probably more or less obtuse; the anterior face of the crown was apparently undulated along its crest, the obscure sulci may have reached half the distance from the crest toward the base, and at the median line a very shallow depression, about as high as it is wide at the base, reaches upward about two-thirds the height of the crown, and seem to interrupt the continuity of the basal folds, which, however, may not be persistent or of specific importance; basal band narrow, linear, with two or three imbricated folds, and parallel with the base of the root; surface coarsely punctate. Root nearly as wide as the crown, its anterior face deeply channeled by an angular transverse furrow, with a low ridge traversing the lower portion from one extremity to the other, below which it is beveled to the outer basal edge.

	Inches.
Greatest breadth, about	1.60
Height,	.50
Greatest height of anterior crown face,	.22

In outline the above species bears a somewhat marked resemblance to *C. loriformis*, N. and W., from the Keokuk limestone; but it differs from that form in having the anterior face of the crown relatively higher, its crest undulated and less parallel, and its bow-shaped outline viewed from above, as well as in the more vertical concavity of the outer aspect of the root. It is not improbable that the basal angle of the posterior crown face was quite prominent, and the vertical concavity of that face of the crown must have been considerable, judging from the arched character of the opposite face, and in this respect somewhat resembling *C. cinctus*, Agassiz, though the present species is not acuminate, the coronal band not nearly as wide as in that species, and the tooth is not as thick and massive.

Form. and Loc.—Upper Coal Measures, Bennet's mill, near Nebraska City.

Genus XYSTRODUS, Agassiz (ms.)

Xystrodus? occidentalis, n. sp.

The collection affords an interesting little Deltoid tooth, which, I believe, has not been heretofore described. Unfortunately, the specimen is quite imperfect, and, although its specific characters permit of description, its generic affinity remains somewhat in doubt.

Description.—Terminal tooth small, subtrigonal in outline, little narrower than long, but slightly inrolled, flattened or gently depressed above; the straight side is abruptly beveled, and from its edge the crown gently inclines to the opposite oblique margin, which is very slightly raised; the border extremity is thickened, forming a well defined continuous marginal border, which rapidly descends upon the inner side and gently slopes into the shallow depressed space in front; toward the terminal extremity

the tooth becomes exceedingly thin, and in the specimen before me the pointed end and outer margin are broken away. The superior surface is coarsely punctate, as is also the straight articular margin. Distance between the angles of the broader extremities .38 inch.

The tooth above described possesses some characters which seem to connect it more closely with *Xystrodus*, Agassiz, (MS.) than with any other genus with which I am acquainted. Its general depressed triturating surface, and but slightly convoluted terminal extremity, are strongly suggestive of this relation. The genus *Xystrodus* was established by Prof. Agassiz, for the reception of *Cochliodus striatus* and two or more other European species from the mountain limestone.

Form. and Loc.—Upper Coal Measures.

DELTODUS? ANGULARIS, N. and W.

Ref.—Newberry and Worthen, Geol. Illinois, Vol. II, p. 97; Pl. IX, Fig. 1.

Description.—Terminal tooth small, obliquely triangular in outline, thick, but slightly inrolled; the broader extremity has a sigmoidal curvature terminating in an acute point at the oblique posterior extremity; straight side forming an angle of about 55° with the oblique margin, abruptly truncated, with a narrow sulcus about the middle of the beveled articular face extending from the inner angle to the pointed end, below which the tooth apparently expands into a thin narrow border similar to that upon the opposite side; the articular margin is bordered by a prominent flattened ridge which occupies about one-third the surface of the crown and gradually narrowing as it approaches the terminal point; a sharp, narrow keel rises from the oblique margin, rapidly converging and decreasing in prominence toward the apical end, and separated from the broad, flattened prominence of the straight margin by an equally broad, deep, angular furrow; along the oblique side the tooth was slightly expanded into a thin marginal border. The crown surface is beautifully granulo-punctate, the broader extremity very faintly marked by longitudinal sigmoid lines of growth, and the broad mesial depression is traversed by very obscure undulations parallel with the oblique keel. Under surface longitudinally undulated, smooth.

Length of tooth along the straight margin, about .52 inch.; greatest distance between the acute and obtuse angles of the broader extremity, .48 inch.

The collection affords but a single example of this handsome form. The specimen before me has a remarkable resemblance to the posterior teeth of *Deltoptychius* Agassiz (MS.), founded upon Cochliodus acutus, of the Irish mountain limestone, but we do not at present possess the materials fully to demonstrate this identity. The Nebraska tooth, however, is evidently identical with the form described by Messrs. Newberry and Worthen, from stratigraphically corresponding horizons in Illinois; and Dr. White has discovered the same, or a very closely allied species, in the Upper Coal Measures of southwestern Iowa.

Form. and Loc.—Upper Coal Measures.

Stated Meeting, May 20, 1870,

Continued from page 385.

The following communication, descriptive of the recent hail storm of the 8th inst., was received from Mr. Hector Orr, of Philadelphia. Mr. Trego, Prof. Cresson, Dr. Coates, and Dr. Horn described the storm as they saw it, and Judge Lowrie compared its features with those of the great hail storm at Pittsburg, which he saw Sep. 30, 1850.

PHILADELPHIA, May 17, 1870.

To the Secretary of the Amer. Phil. Soc.

SIR:—I have not seen any scientific account of the late fierce hail storm of the 8th inst. in print. I noticed the following points of fact connected with it.

The moon entered her first quarter at 10.34′ A. M. that day. Wind from sunrise onward was brisk from N. E. till noon; a light *scud* flying quite low, some two points divergent from the surface current, and a heavy upper stratum of cloud coming nearly from the South. Towards noon the upper clouds showed signs of condensation, and by 2 P. M., the various currents seemed to converge over the city. At this time the sun and moon made nearly equal angles on either side of our meridian, both planets being also well advanced towards the zenith. Rain began to fall about 2.10′, the wind then passing across the pole from N. E. to N. W. For several minutes previous to the fall and at its commencement, the electrical discharges were violent and frequent.

The halting of the clouds directly over head happened within that period of the day in which the sun develops the most heat, and the artificial warmth always present over such a surface as that of the built-up part of Philadelphia, joined to the solar influence, seemed to me sufficient to drive the vapor suddenly upward almost perpendicularly. The concentration, congelation and precipitation, were thus all embraced in a period of thirty minutes.

The demolition of glass shows the wind to have come from the N. W. until the storm reached the line of Sixth street, when it became West, and thus continued to the Delaware. The original breeze entirely spent itself during the fall, for during the last seconds of it the tendency of the stones was slightly from the S. E.—the storm centering itself on the city plot.

Yours, Very Respectfully,

HECTOR ORR.

Dr. Genth communicated a new discovery of rhodium gold in San Domingo, and the results of recent examinations of

dirt excavated in Philadelphia, holding silicate jems indicative of the presence of gold.

Dr. Genth stated that, according to Del Rio, an alloy of gold and rhodium is found in Mexico, which contains from 34 to 43 per cent. of the latter metal. This discovery has never been confirmed, and there is perhaps no mineralogist living who ever has seen it. Some experiments which he has lately made with residues from San Domingo gold leave very little doubt as to the existence of this very interesting substance. Prof. Gabb sent a lot of gold from San Domingo to Dr. Horn, from which the latter dissolved the gold by aqua regia, and placed the very minute residue into his hands! This consisted of scales of Iridosmine, a dull, yellowish substance, in microscopic rounded and angular grains, and a silicate which under the microscope appeared to be topaz. One of the yellowish grains, on being flattened out in an agate mortar, assumed metallic lustre and a pale yellow color. It was almost insoluble in aqua regia, but by treating it for several days with a large excess of this solvent, it was finally brought into solution. A trace of chloride of ammonium was added, and the whole evaporated to dryness and sufficiently heated to reduce the gold. Mixed with this were microscopic reddish crystals, which were dissolved in boiling water, filtered, the filtrate evaporated to dryness, and the residue slightly heated, by which it assumed a reddish brown color. On being fused with bisulphate of potash it gave a slightly rose-colored mass, soluble in water, and precipitated yellow by ammonia. From these reactions there seems to be no doubt that the yellowish grains are rhodium-gold.

Dr. Horn states that the gold received from Prof. Gabb came from the South side of the Island, and contained about 95 per cent. of gold. Dr. Genth remarked that some of the gold from the North side is of a peculiar nature; that several years ago a lot had been sold in this city and New York to jewellers, who stated that they could not work it, as it contained a substance unknown to them. It is very probable that this was also rhodium-gold.

Dr. Genth communicated the result of panning sand and gravel of the Delaware River, dug from a cellar at 106 Arch street. After removing quartz and other light substances, a considerable quantity of heavy black sand remained, which contained a little magnetite, but a large quantity of titaniferous iron (menaccanite). These were treated and dissolved with chlorhydric and sulphuric acid, which left the silicates clean enough for further examination. These consisted principally of very brilliant but microscopic zircons, some garnets and a few yellowish green grains of the appearance of chrysolite. The observed mineral generally accompany gold, but not a particle of the latter could be found. This negative result, however, does not prove its absence, because the quantity of the sands washed was not large and they did not come from the bed rock, where they are always far richer.

Prof. Cope exhibited a portion of the dorsal spine of a

shark of the genus *Asteracanthus* of Agassiz, from New Jersey, the first on record from the United States.* He regarded it as confirmatory of his theory respecting the existence of beds of Jurassic age in that State, though probably of small extent.

Prof. Cope made some observations on the genus *Labidesthes*, Cope, which he had discovered in the Clinch River, E. Tennessee; he said it was an *Atherinid*, having considerable resemblance to the Cyprinodont genus *Belonesox*, having a prolonged premaxillary beak.

Pending nominations Nos. 651 to 659 were read.

The Committee on the Michaux Legacy reported through Mr. Price, that a site for the Oak Grove had been selected.

The Committee on the Michaux Legacy have the satisfaction to report, that in pursuance of the arrangement made between this Society and the Fairmount Park Commissioners, the latter have lost no time in selecting a site for the Grove, in a central portion of the Park westward of the Schuylkill, on the Landsdowne drive. It was selected with a view to suitableness, in furnishing the kinds of soil required by oaks, both upland and low land; dry and moist. There were found already growing, stately oaks of a century's growth, to form at once an impressive scene of shade and sunlight, to become more dense in foliage as the trees recently planted and soon to be planted, shall grow and expand their shade. There have been planted such additions to the previous varieties as could be had near this city. The annexed report of John C. Cresson, the Chief Engineer of the Fairmount Park, shows that seventeen different kinds of oaks are now in the Michaux Grove; and the Park Commission have authorized the importation from France of all other species that will live in this climate; a resource to us for the grove, largely enriched by the scientific labors and zeal of the Messieurs Michaux, who made known to the world the great variety of oaks that were native to this country.

PHILADELPHIA, May 18th, 1870.

Hon. E. K. Price,

Chairman of Committee on Michaux Legacy.

DEAR SIR:—Under the arrangements made for carrying into effect the Will of the late F. A. Michaux, a grove of oak trees, named the Michaux Grove, has been established in Fairmount Park.

*** In the Proceedings of the Acad. Nat. Sci., Phila., No. 1, for Jan.-April, 1870, at page 13, there subsequently appeared the report of a communication on *Asterocanthus iderius*, made by Dr. Leidy, at a meeting held March 22, 1870.**

It now contains one hundred trees of the following species:

Quercus alba.	Quer. fastigiata viridis.	Q. palustris.
Q. bicolor.	Q. Fulhamensis.	Q. phellos.
Q. cerris.	Q. laurifolia.	Q. prinus acuminata.
Q. coccinea.	Q. Leana.	Q. robur.
Q. falcata.	Q. macrocarpa.	Q. tinctoria.
Q. fastigiata.	Q. nigra.	

In pursuance of authority given by the Park Commission, all other species of Oaks that will live in this climate are to be imported from abroad, chiefly from the nurseries of France.

Very Respectfully,

JNO. C. CRESSON,
Chief Engineer.

The following resolution was then passed:

Resolved, That Mr. Durand be respectfully requested to make known to the widow of the late André François Michaux what has been done by this Society, and the City of Philadelphia, through the Fairmount Park Commissioners, towards the carrying out the views of this lover of sylvan culture and benefactor of science, and towards holding his name in honor before the American People and Scientific World.

The resignation of Dr. Wood from the Presidency of the Society, on account of age and ill health, was presented by Prof. Cresson. When, on motion of Dr. Rushenberger, it was

Resolved, That the Secretaries be requested to address a letter to Dr. Wood, requesting him to withdraw his resignation, hoping that he will consent to remain with us as President of the Society.

Mr. Fraley informed the Society that Provost Stillé had been requested to deliver his obituary notice of Mr. Binney, Jun., before an audience of the Union League. On motion of Prof. Cresson, seconded by Dr. Coates, the MSS. was placed at the disposal of the author.

And the Society was adjourned.

Stated Meeting, June 17, 1870.

Present 10 members.

Mr. FRALEY, Vice President, in the Chair.

Photographs for the Album were received from Prof. H. A. Newton, of Yale, and Dr. Jarvis of Dorchester.

A letter announcing the decease of Madame Michaux was read, and on motion, the following resolution was adopted without debate.

Resolved, That M. Carlier be requested to have prepared the proper procuration or Letter of Attorney from this Society to himself, to dispose of the rentes or public loans standing in the name of this Society, being the investment of the Michaux legacy, and to make deposit of the proceeds as the Society may hereafter direct; and also to instruct us as to the manner of executing the procuration.

A letter withdrawing his resignation was received from the President, Dr. Wood.

Donations for the Library were received from the Museum at Beunos Ayres; the Carlo Alberto Observatory; Berlin Academy; London Society of Antiquaries; Essex Institute; B. N. H. S. Edmund Quincy, of Dedham; the Albany State Library; N. Y. Lyceum; Phil. Acad. of N. Sciences; Franklin Institute; Medical News; Mr. Hector Orr; Dr. Brinton; the U. S. War Department, and the Editors of Nature.

Prof. Joseph Henry returned, by request of the late Mrs. Bache, the MSS. correspondence of Prof. A. D. Bache relating to the Society.

Dr. Brinton returned to the custody of the Society Dr. Byington's MSS. Choctaw Grammar.

Prof. Frazer offered for publication in the Transactions a chart exhibiting all the metallurgical processes now employed at Friberg, in Germany, with descriptive text by Persifer Frazer, Jun., which was referred to a Committee consisting of Dr. Genth, Prof. Lesley and Dr. Bridges.

Prof. Cope communicated for publication in the Proceedings a paper entitled: A partial synopsis of the Ichthyology of North Carolina, (see next number of Proceedings) which was referred to the Secretaries.

Dr. Genth made some remarks upon a new meteorite from North Carolina, which he desired to be considered preliminary to a description and full analysis of the same. Prof. Kerr had forwarded photographs of the mass.

Dr. Genth showed also, specimens of metallic lead and metallic iron from Gold tailings on Camp Creek, Montana Territory. The place, circumstances, absence of all meteoric indications, and presence of gold in the lead, support the view that we have here a genuine discovery of lead and iron in a state of nature.

Dr. Genth showed photographs of a new meteoric iron, weighing about twenty pounds, which was found on a small mount in Rockingham Co., N. C.; he made some preliminary remarks on a fragment of the same, which he received from Prof. W. C. Kerr, State Geologist of N. C. The iron is coated with a crust of hydrated sesquioxide of iron. A polished portion of it, after etching with dilute nitric acid, developed the Widmannstaedtean figures, and showed a very remarkable structure of the iron. It is composed of three different kinds of iron; one portion of it is quite homogeneous, and has a very fine granular structure; if, however, the light is reflected in different directions it shows a peculiar glistening, and, very faintly, lines intersecting at angles of about 60° and 120°; this same iron runs into bands of not over 0.5 ^{mm} diameter, which, at another portion of the iron, intersect at angles of about 60. The space between the bands is filled with an iron presenting a reticulated structure. Disseminated throughout the homogeneous iron are crystals of *rhabdite*, but few only show a regular arrangement. A preliminary analysis gave:

Iron	90.41	per cent.	
Nickel (Cobalt)	8.74	"	
Copper	0.11	"	
Iron	0.27	"	Phosphide insoluble in chlorhydric acid.
Nickel (Cobalt)	0.33	"	
Phosphorus	0.14	"	

traces of a quartz-like mineral.

A sulphide of iron of a pale, brass yellow color, and great hardness—probably *pyrite* is mixed with the iron. Dr. Genth intends to give a fuller account of this interesting meteorite at a future day.

Dr. Genth also showed specimens of *native iron* and *native lead* from the bed-rock of gold-placers, and covered with about six feet of gravel, at Camp Creek, Montana Territory, which have been discovered there by Mr. P. Knabe, who kindly communicated them.

The native iron is found in small, angular fragments, but slightly coated with rust; the largest which he has seen is about 0.5 inch in length. Etching with dilute nitric acid does not develop any Widmannstaedtean figures, but a finely granular structure. Mr. Knabe examined

it for nickel and cobalt with negative results. Associated with the iron is native lead, in irregularly shaped rounded and flattened pieces, from the size of a pin's head to about 0.5 inch in diameter. The lead is coated with a crystalline crust of *massicot*, of a sulphur yellow to reddish yellow color; some pieces also show very brilliant but microscopic crystals, which may be *cerussite*. Acetic acid dissolves this massicot, and leaves the metallic lead, which then shows its crystalline structure. A small piece, on dissolving it in nitric acid, left an appreciable quantity of *gold*, but the solution contained no *silver*.

Prof. Cope made some observations on the Reptilia of the Triassic formations of the Atlantic region of the United States. He observed that thirteen species had been described and referred to ten genera. None of these had been referred by their describers to their appropriate orders, and he had undertaken an investigation of them, having for its object such reference, as well as the determination of the closer affinities.

Three of the species he proved to be Dinosauria. He had already assigned Megadactylus and Bathygnathus to this division, and would now add Clepsysaurus, Lea, from evidence derived from an ischium discovered among the original remains. It resembled that of Megadactylus.

Of the remaining ten species, he was satisfied that those referred to Palæosaurus by Emmons, as well as the Compsosaurus and Eurydorus, were founded on posterior teeth of Belodonts. He also said that nothing was to be found in the descriptions of Rhytidodon, Emmons, and Omosaurus, Leidy, to distinguish them from Belodon, to which genus he was inclined to refer the remains which had fallen under his observation. Thus, three species were certainly to be distinguished from the ten, viz: Belodon carolinensis, Emm., (*Rhytidodon*, Emm., *? Centemodon sulcatus*, Lea); Belodon priscus, Leidy, (*Palæosaurus carolinensis*, Emm., *? Compsosaurus priscus*, Leidy, *Clepsysaurus pennsylvanicus* in part, Emmons); Belodon leaii, Emmons, (*Clepsysaurus*, Lea). The above were not asserted to belong to the same genus without doubt, but that evidence to distinguish them was yet wanting. He added a fourth species, discovered by Chas. M. Wheatley, in the Triassic tracks of Phœnixville, Pennsylvania, which was apparently distinct from the above, and of larger size. The remains preserved were dorsal, lumbar and caudal vertebræ, with costal and abdominal ribs; left femur and fibula nearly perfect; portion of pelvis; ungueal and chevron bones, etc. The femur measured thirteen inches in length, and the lumbar vertebræ exhibited slender cylindric diapophyses, which bore ribs to the sacrum. This reptile was named *Belodon lepturus*, and was estimated to have attained a length of about twelve feet.

Eleven of the thirteen species being thus disposed of, there remained

the Dicynodon rosmarus, Cope, and *Rhabdopelix longispinis*, Cope. The latter he had formerly suspected to be a Pterosaurian, but he thought it more likely that it would turn out to be a Rhynchocephalian reptile.

He called attention to four remarkable vertebræ from the Cretaceous green sand of New Jersey, which were characterized by the possession of enormous pneumatic foramina. The articular extremities of the extremities were rugose, and with scarcely any dense layer, so that they probably belonged to an immature animal, and were to be referred to the sacral or lumbar regions. If they belonged to the latter, they indicated a coössification similar to that seen in many birds. That they were not dorsals is indicated by the lack of capitular articulations. The pneumatic foramina occupied half of the centrum along its middle, leaving abutments fore and aft, for the support of the neural arch, which was lost in each one. There were no diapophyses. The neural canal presented a deepening and compression at the middle of the centrum, and a rising and expansion near the articulations. Centra much compressed medially, as well as contracted upwards; articular extremity subtriangular, with rounded angles and notch for neural canal one-third its vertical diameter. Cancellous tissue, coarse, but much finer than in Lælaps; the dense layer thin. The total length of the four, is seventeen and a half inches, the shortest measuring four; the other three, four and a half inches in length. The complete number of six would have measured six inches in length.

These vertebræ had been described as the sacrals of a young Hadrosaurus by Leidy (Cretaceous Reptiles, U. S., p. 100), but there are several reasons for dissenting from this conclusion. The pneumatic foramina of the sacral nerves, which, however, in known Reptiles and Birds, issue *between* the neural arches, not beneath them, not only in the sacral, but in the lumbar and other vertebræ. The reasons for questioning their pertinence to Hadrosaurus were, first: the genus Megadactylus presents similar large pneumatic foramina, and they occur in both the caudal and lumbar vertebræ; the lumbar and caudal vertebræ of two species of Hadrosaurus are known, and do not present any pneumatic foramina whatever, which would scarcely be the case were the present vertebræ sacrals of Hadrosaurus. Second: they form too long a series for the known ilium of Hadrosaurus. From the approximation of the facets for the sacral diapophyses in the type specimens of H. foulkei, it would appear that those vertebræ had somewhat the shortened form of the caudals. Yet the present animal appears to be a young one. Third: the structure is in several respects more Megalosaurian than Iguanodontine. Thus the alternate enlargement and contraction of the neural canal is seen in Palæosaurus and Clepsysaurus; the neural arches appear to have alternated above the articulations of the centra. The pneumatic foramina exist in Lælaps, but of reduced dimensions.

In respect to the presence of the foramina just mentioned, there is a resemblance to the Ornithopsis hulkei, recently discovered by Seeley, though here the comparison ends. In that form the cancellous texture of the centrum is extremely open and light, and composed "of enormous

honeycomb-like cells of irregular polygonal form—for the most part long in the direction of the length of the centrum, and divided by exceedingly thin and compact films of bone," etc. The structure in the subject of the above description is spongy and light, but much closer. Lælaps offers a much closer resemblance to Ornithopsis in its exceedingly coarse structure; while in Megadactylus, lumbar vertebræ appear to be absolutely hollow.

Had Dr. Seeley been acquainted with these genera, he would probably have referred Ornithopsis to the Goniopod Dinosauria, rather than to the Ornithosauria. Prof. Cope added that he had already (Aug. 1869,) published the view that the bone described previously as a quadratum of Iguanodon, (the type of Seeley's Ornithopsis), was evidently not a cranial bone, and that he had always supposed it to be a vertebra.

The reptile represented by the above vertebræ was named *Pneumatoarthrus peloreus;* the possibility of its being found to be *Ornithotarsus* being entertained, though the near resemblance of the bones to those of a tortoise could not be overlooked. The specimens were discovered by Dr. John H. Slack, in Monmouth Co., N. J.

Prof. Cope exhibited also seven Australian skulls and one Maori skull, probably the first seen here.

Pending nominations, Nos. 651 to 659 were read.

And the Society was adjourned.

Stated Meeting, July 15, 1870.

Present, four members.

Dr. Genth in the Chair.

Letters of envoi were received from various correspondents.

Letters of acknowledgement for the receipt of No. 83 were received from the Essex and Smithsonian Institutes, Massachusetts, New York, New Jersey, and Georgia Historical Societies, Cambridge Museum, and New York Lyceum; Nos. 77 to 80, R. Danish Society; 77 and XIII. 2, Zool. Bot. Soc., Vienna; 78—80, Physical Society, Berlin; 76—80, Nassau, N. H. Association.

Donations for the Library were received from the Academies at St. Petersburgh, Berlin, and San Francisco; the Insti-

tutes at Salem, Albany, Philadelphia, Baltimore and Washington; the Societies at Königsberg, Vienna (Zool. Bot. and Anthropological), Leipsig (P. Jablon. and R. Saxon), Görlitz, Berlin (Geological, Physical and Horticultural,) Bremen, Wiesbaden, Bonn, Strasbourg, Bordeaux, London (R. Astronomical and Chemical), and Leeds; the Observatories at Munich, Montsouris and Oxford; the Universities at Liège; the Museums at Salisbury and Cambridge, Mass.; the Italian Geological Commission; MM. Manjini and Denra; American Medical Journal; Messrs. Elihu Thompson and A. Gebow; the International Exposition Commission at Washington, and the editors of "NATURE;" and the Chinese Recorder at Foochow.

The death of Sir James Clark, of London, aged 82, was announced by the Secretary:

The committee to which was referred the Chart of Freiberg processes, by Percifer Frazer, Jr., reported in favor of its publication in the Transactions, which was so ordered.

Prof. Cope communicated for the Proceedings, a Register of Meteorological Observations made at Bois Chêne, near Port au Prince, Hayti, by Prof. A. Ackerman, Phys. Sciences National Museum.

Communications respecting the Michaux Legacy, and respecting Mr. Peale's Cabinet of Antiquities, were made to the meeting.

Nominations Nos. 651, 652, 654, 655 were postponed.

The ballot boxes being examined by the presiding officer, the following persons were declared duly elected members of the Society:

Dr. C. W. Boekh, of Christiana, Norway.
Dr. Wm. Pepper, of Philadelphia.
Rd. E. R. Beadle, of Philadelphia.

And the Society was adjourned.

A PARTIAL SYNOPSIS OF THE FISHES OF THE FRESH WATERS OF NORTH CAROLINA.

By Edw. D. Cope. A.M.

Read before the Amer. Philosophical Society, June 7, 1870.

The material on which the present investigation is based was, for the most part, procured by the writer during the autumn of 1869. A journey from the Cumberland Mountains of Tennessee to the ocean, offered opportunity for making collections in the waters of five hydrographic basins, viz. : those of the Cumberland, Tennessee, Catawba, Yadkin and Neuse. The streams of the Tennessee examined were the Clinch and French Broad ; the former in a tributary called Coal Creek, in Anderson Co., Tenn.; the latter at various points, both in the mountainous part of its course, and in the elevated and flat valley of Henderson Co., where it takes its rise. A small seine with fine meshes, kindly lent me by the administration of the Smithsonian Institution, was used in the smaller streams ; and fishermen's apparatuses, especially weir traps, furnished most of the species inhabiting the river channels. Passing many of the latter at the time of year when the migratory fishes were descending, the writer was able to examine and procure them in great numbers. The opportunity of seeing fishes in life, it is believed, is no small aid to their proper specific determination.

ACANTHOPTERYGII.

PERCA, Linn.

1. Perca flavescens, Cuv.

Neuse River.

ROCCUS, Gill.

2. Roccus lineatus, Bloch.

Neuse River.

STIZOSTEDIUM, Raf.

3. Stizostedium americanum, C. V.

This is the largest Percoid of the Western waters, occasionally attaining a weight of 35 lbs.: no specimen of more than 10 lb. came under my observation. It loves the most boisterous and rapid streams, ascending them to near their sources, having much the manners, and haunting the same waters as the trout, but of much more voracious habits. Its swiftness enables it to take the black perch (Micopterus fasciatus) with ease, though that fish is, after it, much the most powerful swimmer of the rivers it inhabits. I took two from the stomach of a Lucioperca of eight pounds, one of which weighed 2½ lbs. Suckers are used as bait in taking them by hook ; but the mode in which large specimens are most readily taken is by shooting. When the Lucioperca has gorged himself, he seeks some shallow bayou, and lies in a sluggish state, digesting his meal. Then

the gun-fisherman, concealed in a tree close by, makes sure of him. It is the most valued food-fish of the French Broad, the flesh being very tender as well as rich.

Without the opercular armature of the Percae, its chief defence is in its numerous and powerful canine teeth, with which it makes serious wounds on the hands of the unwary fisherman. The common name on the French Broad is "Jack."

4. STIZOSTEDIUM SALMONEUM, Raf.

This fine species was described to me as an inhabitant of the French Broad, though I did not see it. As elsewhere, it is called Salmon. A species of this genus occurs also in the Neuse.

ETHEOSTOMA, Raf.

5. ETHEOSTOMA NEVISENSE, Cope.

Proc. Amer. Philos. Soc., 1870, p. 261.

Turbulent waters of the Neuse River.

6. ETHEOSTOMA MACULATUM, Girard.

Putnam Bull. Mus. Comp. Zool., Cambridge, No. I. Cope. Proc. Am. Phil. Soc., 1870, 262. *Hadropterus maculatus*, Girard. Proc. A. N. S, Phil., 1859, 100.

Abundant in the rapid waters of Buck Creek, which empties into the Catawba, in Marion Co., N. Ca.

HYPOHOMUS, Cope.

Cottogaster, Cope, Journ. Acad. Nat. Sci., Phila. 1869, 210, not of Putnam.

The name *Cottogaster*, my friend Prof. Putnam informs me, was applied to species of the type of *Boleosoma*. It is, therefore, inapplicable to the *C. aurantiacus*, to which I apply the above generic name. The characters of the genus have been pointed out as above cited. They are those of Etheostoma, excepting the median ventral series of shields, which are here wanting.

7. HYPOHOMUS AURANTIACUS, Cope.

Jour. Acad. Nat. Sci., Phila., 1868, 211.

One specimen from the French Broad River, in Madison Co., North Carolina, measuring 4 inches 8 lines in length, more than twice the size of the types, and larger than any species of the Etheostomine group, excepting *Percina caprodes*. Color in life bright yellow, with a black lateral band, and a few brown spots on each side of the dorsal fin.

POECILICTHYS, Agass.

8. POECILICHTHYS VITREUS, Cope.

Proceed. Am. Phil. Soc. 1870, 253.

This species is quite translucent in life. The only specimen taken was

adult, and exhibited ovaries well filled with well developed ova. Seven green dorsal spots, and eight or nine linear spots on the sides, of the same color.

Walnut Creek, a tributary of the Neuse River.

9. POECILICTHYS FLABELLATUS, Raf.

Cope, Jour. A. N. Sci., Phil., 1868, 213. *Catonotus*, Agass., Putn. Bull. M. C. Zool., I.

Var. Cope, Proc. Am. Phil. Soc., 1870, 263.

From the Catawba River.

10. POECILICHTHYS VULNERATUS, Cope.

Proceed. Am. Phil. Soc., 1870, 266.

A beautiful species from the Warm Springs Creek, Madison Co., N. Ca., a tributary of the French Broad River.

11. POECILICHTHYS RUFILINEATUS, Cope.

Loc. cit., 267.

Abundant in the same localities as the last, and one of the most ornate species of the genus.

12. POECILICHTHYS ZONALIS, Cope.

Jour. Acad. Nat. Sci., Phil., 1868, 212, Tab. xxiv., f. 1.

French Broad River.

BOLEOSOMA, DeKay.

Cope, Proc. A. P. Soc., 1870, 268.

13. BOLEOSOMA EFFULGENS, Girard.

Cope, l. c. *Arlina effulgens*, Girard. Proc. Acad. Nat. Sci., Phil., 1859, 64.

Deep River, Guilford Co., North Carolina, from Samuel C. Collins.

14. BOLEOSOMA MACULATICEPS, Cope.

Proc. A. P. Soc., 1870, 269.

Upper waters of the Catawba River.

HYOSTOMA, Agass.

Cope, Jour. A. N. Sci., Phil., 1868, 214.

15. HYOSTOMA CYMATOGRAMMUM, Abbott.

French Broad River.

MICROPTERUS, Lac.

Grystes, Cuv. Val.

16. MICROPTERUS FASCIATUS, DeKay.

Apparently not found east of the great Water Shed: I only obtained it in the state in the French Broad. Also from the Clinch and the Cumberland.

17. MICROPTERUS NIGRICANS, Cuv.

The green bass is abundant in all the rivers of the State. I have it from the Neuse, Yadkin, Catawba, upper and lower French Broad, and from the Clinch in Tennessee. Specimens from the Neuse and from near Norfolk, Virginia, six in number, differ from those of the other rivers, in having a deeper body, and generally longer and more prominent mandible. The depth enters the length 2.75 times; in the more western forms always 3.25 times; in the former it is greater than the length of the head, in the latter it is considerably less. Other differences are not discoverable and I regard it as a marked variety only.

POMOXYS, Raf., Agass.

18. POMOXYS HEXACANTHUS, C. V.

Neuse River.

Numerous specimens of this species and the *Pomoxys storerius* from Leavenworth, on the Missouri River, from Saml. H. Edge.

CENTRARCHUS, C. V.

19. CENTRARCHUS IRIDEUS, Cuv., Val.

Vol. III., p. 89, Holbrook Ichth. S. Ca., 18, Tab. III., fig. 1.

From the Neuse River. A specimen presenting an additional dorsal and anal ray, as compared with the description of Cuvier and Valenciennes; but Holbrook adds one to the anal spines, thus agreeing with anal formula D. xii., 14, A. viii., 15. Of a brilliant pea green in life, without ocellus on second dorsal, as described by the above authors. Soft dorsal and anal, with narrow, blackish bars. Not probably specifically distinct from specimens in Mus. A. N. Sci., from South Carolina.

AMBLOPLITES, Raf., Agass.

20. AMBLOPLITES RUPESTRIS, Raf.

Centrarchus æneus, Cuv. Val.

Abundant in the French Broad and head of Cumberland; none found east of the Alleghenies.

CHÆNOBRYTTUS, Gill.

This genus, for which I have reserved the above name, is equally allied to *Lepomis* and *Ambloplites*. It agrees with the first in its entire and rather produced operculum, and three anal spines, but differs materially in possessing the additional maxillary bone of the latter, *Centrarchus*, *Pomoxys*, etc. Gill defined it in consequence of its palatine and lingual dentition, characters which exhibit various grades of imperfection to entire extinction in the typical Lepomes. Hence, in my view of fresh water fishes from the Allegheny region of southwest Virginia, I united Lepomis, Bryttus, and Chænobryttus. I now discover the importance of the presence or absence of the additional maxillary bone, which, with the

emargination of the operculum previously pointed out, enables me to define the genera more satisfactorily than my predecessors. Thus they may be arranged in four groups.

I. Operculum emarginate; a supernumerary maxillary bone:—Micropterus, Ambloplites, Pomoxys, Centrarchus, Acantharchus, Enneacanthus (?) Hemioplites.

II. Operculum emarginated; no supernumerary maxillary:—Mesogonistius.

III. Operculum entire, produced; an additional bone attached to the maxillary:—Chænobryttus.

IV. Operculum as last; no supernumerary maxillary:—Lepomis, Pomotis.

21. Chænobryttus gillii, Cope.

Lepomis gillii, Cope. Jour. Acad. Nat. Sci., 1868, 225.

This species is exceedingly common in all the streams of North Carolina east of the Allegheny Mountains. It does not occur in the French Broad. All the specimens have clouded markings on the sides, which in the young, are broad, distinct olive-brown cross-bands, which embrace pale spots, giving a chain-like pattern. Fins blackish, cross-barred; four brown bands radiating backwards from orbit. Iris bright red. The species is rarely seen more than five inches long, and prefers rather still waters. It bites the hook very readily, and is called the red-eyed bream on the Catawba.

The *C. mincopas*, Cope, possesses the additional maxillary, and I have no doubt the *C. melanops* (Gill's type), and the *C. charybdis*, Cope, though I have not been able to verify it on the latter.

ENNEACANTHUS, Gill.

Jour. A. N. Sci. Phil, 1863, 218.

22. Enneacanthus guttatus, Morris.

Proceed. Acad. Nat. Sci., Phila., 1858, p. 3.

Abundant in the Neuse River in still water, as in Virginia and New Jersey.

LEPOMIS, Raf.

23. Lepomis rubricauda, Holbr.

This marked species, the southern representative of the *L. appendix* is very common in the hydrographic basins of the Catawba, Yadkin and Neuse. In life the second dorsal and caudal fins are red, and there is a bay spot at the base of each scale forming interrupted stripes. Flap of operculum black, the continuation of a dark shade from the preoperculum, which is bordered above and below by a blueband; two blue lines on operculum below the latter.

24. Lepomis megalotis, Raf.

L. incisor Cuv. Val.

From the upper waters of the French broad.

There are several species allied to the present, which may be distinguished, as follows:

Scales 4—35—11.

Dorsal spines short, longest equal muzzle and orbit to pupil; mucous cavities small; eye four times in head with long flap, which is black, red bordered below and behind; anal spine reaching base last anal ray.

L. PELTASTES.

Scales 5-7—36-47—2-14.

Spines of dorsal shorter, equalling muzzle and half orbit; third spine of anal not reaching base of last anal ray; ear flap long, blue edged below; pectoral scales large; a spot on second dorsal. L. MEGALOTIS.

Spines etc., as above; pectoral scales small, no spot on second dorsal. L. c. 41—4. L. NITIDUS.

Spines longer than the above, dorsal equal muzzle and orbit .5 or head; anal reaching base last ray; opercular flap very small not lighter margined; spot on second dorsal.

L. c. 36—9. L. NOTATUS.

Spines longest, more than muzzle and orbit; anal extending beyond last anal ray; ear flap very short, not light margined; spot on second dorsal. L. SPECIOSUS*

Eye .33 of head; scales 7—47; spines long, equal muzzle and orbit; anal ray extending beyond base last anal; opercular flap very small; spot on second dorsal. L. PURPURESCENS.

Lepomis nitidus, Kirtland.

L. megalotis, var. B. Cope Journ. A. N. Sci., Phila., 1865, p. 220.

Common in Coal Creek a tributary of the Clinch River; not seen in North Carolina.

25. LEPOMIS NOTATUS, Agass.

Amer. Journ. Sci. Arts, XVII, 302.

This species is allied to the *L. ardesiacus*, Cope (l. c., p. 222), but its scales are larger, there being but 36—9 on the lateral line, and 13 below it, while there are 45, with 17 below, in the latter. The eye is also larger, entering the head only three times, while it is measured four times by the same in on L. *ardesiacus* of the same size.

The general form is elongate oval, the front of dorsal region steep, the muzzle conic and not obtuse. Eye large and round, its diameter measuring muzzle and half itself, and .2 more than interorbital width: R. D. X. 11, A. III. 10, Depth 2.33 times in length to end of lateral line. Four rows scales on cheek; no palatine teeth. Scales above lateral line, five large series and one small one. Length 3. 5 inches. Color uniform greenish brown, below yellowish; no band. No red on the very small opercular spot. Fins not cross-barred

Very abundant in the upper French Broad River, North Carolina, and the tributaries of the Clinch, East Tennessee.

*LEPOMIS SPECIOSUS, Girard. *L. heros* Girard. *L. longispinis*, Cope, Journ. A. N. Sci., 1868, 220: from Texas.

This is probably Agassiz species as above, but the orange on the opercular flap scarcely extends posterior to the black spot, and is easily lost sight of in spirits.

26. Lepomis purpurescens, Cope.

Species nova.

This is an elevated compressed fish, with very small or rudimental opecular flap, like the L. *notatus*, *L. ardesiacus* and *L. nephelus*. It is similar to the first, and different from the *L. ardesiacus* in its large eye, which enters the head scarcely three times, and the interorbital width .75 times, but agrees with the latter in its small numerous scales. Thus there are six rows of equal scales above the lateral line, and one small one, and 47 on the lateral line and 13 below it; (in the *L. ardesiacus* there are 17 below it.) Depth 2.25 to 2.33 in length (exclus. caudal fin.) The spinous rays of this fish are nearly as long as in the *L. speciosus*. The caudal fin is longer than usual, equalling at least, the head. Length of latter, three times in length of body + head. Six rows scales on the cheek. Length three inches. Mucous cavities small.

Color in life a pale silvery lilac, darkest in four or five vertical shades across the sides, which disappear in alcohol. Fins unicolor except dark shades on middle of anal, and second dorsal and edge of caudal, with a black spot at lower posterior portion of second dorsal.

Abundant in a tributary of the Yadkin River in Roane County, North Carolina.

Lepomis peltastes, Cope.

A deep stout species of small size, distinguished for its large scales, short spines and bright color; mucous caverns small. Eye large, equal muzzle, four times in length of head with long opercular flap, just equal interorbital width. Head with flap 2.5 times in length; depth 2.1 times in same. Caudal fin and peduncle considerably more than one-third the length. Longest dorsal spine equal from end muzzle to middle of pupil; longest anal reaching base last anal ray.

Five rows scales on cheek, three large and two small rows above lateral line; those of middle of sides larger than those on lower part. The profile is regularly descending to end of muzzle; front but little concave. Radii D. X. 11. A. III. 10. Length three inches.

Color above golden brown, sides and belly golden, top of head blackish. Large black opercular spot, red margined below and behind. I dorsal fin blackish, II D. blackish at base orange above, anal similar, caudal blackish, ventrals more or less black. The pectoral fins do not quite reach the base of the anal fin.

This species is from the Huron River, Michigan, whence it was procured through the kindness of my friend Prof. Alexander Winchell, Ann Arbor, Michigan. Its relationships are to the *L. oculatus*, Cope, but in that species the eye is smaller, and the tail and peduncle are .33 of the length. In *L. anagallinus* the mucous caverns are much larger.

POMOTIS, Cuvier.

27. POMOTIS MACULATUS, Mitchill.

Morone Mitchill, *P. vulgaris*, Holbr.

From all the rivers of North Carolina east of the Allegheny Range. Identical with specimens from Pennsylvania and Michigan.

URANIDEA, Dekay.

28. URANIDEA CAROLINÆ, Gill.

Proc. Bost. Soc. Nat. His., 1861. 41.

Abundant in the French Broad River in Madison County, North Carolina.

APHREDODIRUS, Lesueur.

29. APHREDODIRUS SAYANUS, Gilliam.

Journ. A. N. Sci., Phila., IV, 81, pl. III; Dekay, N. Y. Fauna, Fishes p. 35, pl. xxi., fis. 62.

Abundant in sluggish waters tributary to the Neuse River in Wake County, North Carolina.

LABIDESTHES, Cope.

Fam. *Atherinidæ*. Premaxillary bones prolonged anteriorly into a roof-shaped beak of elongate form, moderately projectile; reaching posteriorly to the line of the orbit: its teeth in several series. Mandible as long as the muzzle. No palatine teeth.

This genus differs from Chirostoma (*Atherinopsis*, Blkr.) in the duck-like muzzle, which is almost exactly like that of the *Belonesox belizanus*, though shorter. Like it, the premaxillaries are not coössified, and are separated on the superior surface by a groove between the median portions. The general characters remind one so of Belonesox, as to strengthen the belief in the close relationship existing between Atheridæ and Cyprinodontidæ, though the form is Acanthopterygian, and the latter Malacopterygian.

Labidesthes sicculus, Cope.

Chirostoma sicculum, Cope. Proc. Acad. Nat Sci., Phila., 1865, p. 81.

Form slender, the depth contained in the length (without caudal fin) seven times; the length of the head 4.33 times in the same. The eye is large and round, contained 3.6 times in the head, 1.5 times in the length of the muzzle and once in the interorbital space. The top of the head and muzzle are plane, the latter convex transversely, and not exceeded by the extremity of the mandible. Front with a median ridge. A distinct ? mucous pore above each orbit. The teeth

Fig. 1.

are elongate, slender and simple. The premaxillaries are a little projectile; extremity of maxillary acuminate. The first dorsal commences at a point mid-way between the basis of the tail and the anterior margin of the orbit, or opposite the 3–4th anal radii. The second dorsal commences above a point a little in front of the middle of the anal. Radii D. IV. 10; A. I. 22–3; V. I. 5; P. 12. The scales are small, in 14 longitudinal, and 75 transverse series.

In life this fish is translucent, with a silver band on each side, which covers one scale and two halves, and is lead-edged above. The dorsal region and top of head are dusted minutely with black. Operculum and cheek silvery.

	M.
Length,	0.074
Of head,	0.015
Of pectoral fin,	0.011
Base of anal,	0.018
Width head behind,	0.006

This little fish I took in great abundance in Coal Creek, a tributary of the Clinch, in East Tennessee. It was very abundant, and easily caught in rather sluggish water. The stream named passing through a limestone region, is liable to partial desiccation in the Autumn, and in several pools, thus formed, I obtained this species.

In the original description I gave D. V., which should probably be as here stated, D. IV.

MALACOPTERYGII.

FUNDULUS, Lac.

30. FUNDULUS CATENATUS, Storer.

Cope, Journ. A. N. Sci., Phil., 1868, Tab. xxiv., fig. 2.
Clinch River, abundant.

HAPLOCHILUS, McClelland.

I refer the following species to this genus, without going into its synonymy, following the arrangement given by Günther in the Catalogue of the British Museum. In consideration of the peculiar views of this author respecting specific and generic characters, I consider this a temporary arrangement, to be rectified by a more thorough analysis of the subject at some future time.*

**Fundulus nisorius*, Cope, Sp. nov.

Stout; head four times in length to basis caudal; orbit four times in length of head, and twice in inter-orbital width. Depth 3.75 times in length. Anal fin commencing about opposite the middle of the dorsal. Cheek scaly, operculum smooth. Scales of body in. 36 transverse, and 12 longitudinal series. Radii D. 12, A. 10 or 11, extending more than half way from basis of first ray to basis caudal. Length of female, four inches. Color uniform light brown, yellowish below.

Most of the specimens of this species (seven) are females, and in them the oviducts are prolonged in a tube to near the extremity of the first ray of the anal fin. Several have many well developed eggs in the former. Small, faintly cross-banded specimens, perhaps males, do not pre-

31. HAPLOCHILUS MELANOPS, Cope.

Sp. nov.

First dorsal ray opposite middle of anal. Scales in. 31 transverse, and 9 longitudinal series. Radii D. 1.6, A. 1.8, V. 6. Head 3.66 times in length, exclusive of caudal fin; eye 3 times in head, 1.6 times in interorbital width. Dorsal and anal fins each short, each measuring less than half the distance from their first ray to the basis of the caudal fin. Caudal narrowed, rounded.

Above, yellowish brown, scales darker edged, a few longitudinal lines on some dorsals; in some specimens, a median brown dorsal line. Dorsal and caudal fins each with a row of black dots across the middle, and one near the margin. Belly golden. Length 1.5 inches, the largest size. A blue-black spot below the eye in most specimens.

Very abundant in still waters of the Neuse basin, Wake Co., N. Ca.

ESOX, Linn.

32. ESOX AFFINIS, Holbrook.

Ichth. S. Carolina, 198, Pl. xxviii., fig. 1.

This species is near to but distinct from the *E. reticulatus* of the North. In life it is of a bright light emerald green, with dark reticulations. Common in the Neuse River.

33. ESOX RAVENELII, Holbrook.

Ichthyology South Carolina, p. 201, Pl. xxvii., fig. 2.

Length from muzzle to pectoral equalling length from pectoral to ventral fin; latter space embracing 37 transverse series of scales. From end muzzle to orbit less than from orbit to opercular border. Br. XIII. D II. 12. Brown above with brown cross-bars; edge of dorsal and caudal fins red.

This species is near *E. americanus*, but has a relatively longer head. Size and color similar. From the Catawba River, N. Ca.

SEMOTILUS, Rafinesque.

Putnam, Cope.

34. SEMOTILUS CORPORALIS, Mitchill.

From the French Broad, Catawba, Yadkin, Deep, and Neuse Rivers.

CERATICHTHYS, Baird.

Four species of this genus were observed, of which two are new to Zoology. They both belong to

Sect. II., mouth more or less inferior, small; teeth 4–4 or 4. 1.—1. 4; size small.

Depth less than length head; last dorsal ray more than half first; muzzle narrow, beards long; small; C. LABROSUS.

sent this character. There are no pseudo-branchiae. From Gaboon, W. Africa. P. B. DuChaillu.

It may be stated in this connection that the genus called *Lycocyprinus* by Peters, for Haplochiloid fishes with pseudobranchiæ, was previously named Epiplatys by Gill. The type of the latter, (E. sexfasciatus, (1862) from Gaboon, is different from the *E. (L.) sexfasciatus* (1864), the type of Peters. The latter may, therefore, take the name of *E. infrafasciatus* (1865), which Günther gave the same species, subsequent to Peters.

Depth equal length head; last dorsal ray less than half first; muzzle broad, beards small; C. HYPSINOTUS.

35. CERATICHTHYS LABROSUS, Cope.

Spec. nov.

This is a peculiar species of slender proportions. The top of the head is gently decurved to a muzzle which scarcely overhangs the thick, projectile upper maxillary arch. The mouth is entirely horizontal, and the extremity of the maxillary bone attains the line of the orbit. The latter enters the length of the head 3.75 times, and is just exceeded by the inter-orbital width. The head enters length to origin caudal from 4 to 4.5 times. Front arched in transverse section. Depth 5.5 times in length. The dorsal line is nearly plane, and the elevation of the first dorsal rays is contained twice in the length from its base to the anterior rim of the pupil: it stands over origin of ventral. Scales large 6—34-5—4. Radii D. 8; A. 8.

	Lines.
Total length	29.5
Of caudal fin	5.1
Of head	5.8

Teeth 4. 1——1. 4.

This fish is silvery from the middle of the sides downwards. In some specimens there are numerous blackish scales above the lateral line, which are arranged so as to form indistinct cross-bars in life; in other specimens the color is quite transparent, indicating two varieties. The latter are frequently a little more slender than the former.

The beards of this species are relatively longer than in any other species of the genus. The prominent lips remind one of Phenacobius. The species is not uncommon on the bottom in clear and rapid creeks which flow into the upper waters of the Catawba River, in Macdowell and Burke Counties, N. Ca.

36. CERATICHTHYS HYPSINOTUS, Cope.

Spec. nov.

This little species has a stout robust form. The head and muzzle are broad and flat; the muzzle is not prominent; the mouth is inferior and horizontal; the maxillary just reaches the line of the orbit. The form is characterized in the genus by the gradual elevation of the dorsal line to the base of the first ray of the dorsal fin, and its rather abrupt descent from that point. The base of this fin is thus oblique and the distal outline is vertical; the posterior ray being less than half as long as the anterior. This produces a characteristic appearance. The head is short and enters the length 3.75 times, equalling the depth. Body compressed. Orbit 3.5 times in length head, and once in inter-orbital space. Lips, especially inferior, thin; beards small. Scales, 4-5——38-41——3. Teeth 4. 1——1. 4. Dorsal fin originating a little in advance of above ventrals; 8. A. smaller than dorsal, 8.

	Lines.
Length	33.6
Caudal fin	6.5
Depth	7
Width head behind orbits	3.5

Color in life silvery, with a double series of black specks along the lateral line, and a lateral band of dusted blackish; a dark line round muzzle between orbits. Membrane of dorsal fin often shaded with blackish.

Common in creeks heading the Catawba R., in Macdowell Co., N. Ca., or tributary to the Yadkin River in Roane Co., in the same State.

37. CERATICHTYHS HYALINUS, Cope.

Jour. Acad. Nat. Sci., Phil., 1868, 226.

From the French Broad and Clinch Rivers in North Carolina and Tennessee; not found east of the Alleghenies.

38. CERATICHTHYS BIGUTTATUS, Kirtl.

Trans. Amer. Philos. Soc., 1866, 366.

Found in the rivers of East Tennessee and North Carolina, from the heads of the Cumberland, to, and including, the Neuse.

ARGYREUS, Heckel.

39. ARGYREUS LUNATUS, Cope.

Proc. Acad. Nat. Sci., 1864, 278. Jour. Acad. Nat. Sci., 1868, 228, Tab. 23, fig. 3.

Common in the tributaries of the French Broad and Holston Rivers, in North Carolina and Tennessee. The absence of any species of this genus in the rivers of North Carolina east of the Alleghenies is a peculiar feature. They no doubt occur in the Roanoke, as I have taken *A. atronasus* from that river in Virginia.

HYPSILEPIS, Baird.

40. HYPSILEPIS COCCOGENIS, Cope.

Proceed. Acad. Nat. Sci., 1867, 160.

Common in the French Broad and Clinch Rivers. Not found in the Beech Fork of the head of the Cumberland.

41. HYPSIEPIS CORNUTUS, Mitch.

Var. *frontalis*, Agass., Cope, l. c., 158.

Abundant in Coal Creek, a tributary of the Clinch River in Tennessee: Var. *cornutus*, Cope, l. c. From the Neuse River.

42. HYPSILEPIS ANALOSTANUS, Girard.

Cope, l. c., p. 161.

Found in abundance in the Catawba River, but nowhere in the tributaries of the Tennessee or Cumberland. Found in the Neuse River.

43. HYPSILEPIS GALACTURUS, Cope.

Loc. cit., 160.

Most common in all the tributaries of the French Broad, Clinch and Cumberland. It does not occur east of the Alleghenies.

Hypsilepis ardens, Cope.

Loc. cit., p. 163.

Abundant in the headwaters of the south fork of the Cumberland River in Tennessee. In my examination of the Virginia streams, I did not find it in any western water, but only in the Roanoke and James Rivers.

HYBOPSIS, Agass.

Cope. Transac. Amer. Philos. Soc., 1866, 379.

GROUP A.

44. HYBOPSIS AMARUS, Girard.

Proceed Acad. Nat. Sci., Phila., 1856, 210. *Hybopsis phaënna*, Cope, l. c. 1864, 279.

Specimens from the Catawba River all have a relatively longer head than typical examples from the Potomac; former 4 times in length to basis caudal fin; latter 4.5 times. They have also teeth 4.1—1.4, in place of 4.2—2.4; the three inferior of the outer row obtuse, without hook, the superior one only with masticatory face. Both varieties may really belong to the H. hudsonius, as indicated in Monograph Cyprinidæ Pennsylvania.

GROUP B.

Hybopsis longiceps, Cope.

Journal Acad. Nat. Sci., Phila., 1868, 231.

Abundant in the head waters of the Cumberland River, and Coal Creek, a branch of the Clinch River, Tennessee. Originally found in the Roanoke and James Rivers, Virginia.

45. HYBOPSIS SPECTRUNCULUS, Cope.

Loc. Cit. 231.

From the tributaries of the French Broad in the high valley of Henderson County, North Carolina.

GROUP B B.

Teeth + 4. 4 +; mouth horizontal, lower jaw received beneath upper.

46. HYBOBSIS NIVEUS, Cope.

Spec. nov.

Char. Head 4.5 in length; depth 5 times in the same; eye 3. 3 in head, equal muzzle. Scales $\frac{6}{38-40}$; anal 1. 8. White, a black spot on dorsal fin behind.

Description. This is a regularly fusiform fish, the dorsal region more arched than the ventral. Head conic, muzzle obtuse, not projecting, mouth nearly terminal; preorbital large, longer than deep. Occipital region arched, its breadth at superior extremity of operculum equal from end muzzle to middle pupil. Muzzle about equal orbit, preorbital bone elongate; end of maxillary extending to opposite anterior rim of orbit.

Mouth slightly oblique downward, mandible included; isthmus medium. Fins D. I. 8, A. I. 8; the osseous dorsal ray separated from the first cartaliginous by a narrow membrane, and originating above the ventrals. Posterior ray 3-5 length of the anterior.

Length 31.3 lines; of caudal 5.8 lines; to basis dorsal 12.9 lines. From basis to apex pectorals 4.1 lines; same to basis ventrals 13 l.

Color in life very pale, sides and below silvery; a blackish spot at basis caudal, and a large dark spot at upper posterior part of dorsal fin.

Common in the upper waters of the Catawba River, North Carolina.

GROUP D.

Teeth 4.1—1.4; lateral line little decurved; scales $\frac{(5)-6}{39}$ muzzle short obtuse; interorbital region wider; depth 5; head 4 times in length. A. I. 8.
H. CHLOROCEPHALUS.

Teeth 4.2—2.4; lateral line much decurved; scales $\frac{7}{34-7}$; muzzle acuminate, interorbital space narrower; depth 5.5, head 4 times in length. A. I. 8.
H. CHILITICUS.

47. HYBOPSIS CHLOROCEPHALUS, Cope.

Spec. nov.

This small species is rather stout and has a deep caudal peduncle. The head is broad with large orbit, descending muzzle, and descending mouth, orbit in head three times, diameter exceeding length of muzzle. End of maxillary extending beyond line of orbit; premaxillary margin barely reaching plane of lower margin of pupil. Interorbital width much more than length of muzzle. Lateral line moderately decurved. Dorsal fin above ventrals, elevated: R. I. 8, A. I. 8.

Length (total) 27 lines; to origin dorsal 11.9 lines; to basis caudal 21.6 lines. Everywhere, except on belly and below orbits, thickly dusted with blackish, especially gathered into a lateral band which terminates in a basal caudal spot. Fins unspotted, in life a metallic green line on the vertebral line, and one from the upper angle of each operculum to caudal, visible in several lights; below the latter, dark crimson; dorsal and caudal fins, operculum and cheek with end of nose, all crimson. Part of operculum, properculum, postfrontal region and top of head metallic green.

This surpassingly beautiful fish is abundant in the clear waters which it inhabits, viz: the tributaries of the Catawba River.

This species may be compared with H. rubricroceus and H. plumbeolus as its nearest allies. The former has a relatively larger head, and more slender caudal peduncle, A. 1. 9. The latter is much shorter and deeper fish; its depth enters the length 4.6 times; the eyes the head only 2.75 times.

48. HYBOBSIS CHILITICUS, Cope.

Spec. nov.

This species is an ally of the last; it has a more clupeoid aspect, seen in strongly decurved lateral line and more acuminate muzzle. Head broad behind occiput, convex, interorbital width less than length of muzzle, orbit 3 times in head, exceeding length of muzzle; maxillary extending beyond its anterior rim. Teeth 4.2—2.4. Dorsal small, originating above ventrals, R. 1. 8, A. 1. 8. Line of premaxillary margin opposite middle of pupil.

Length 24.4 lines; to basis dorsal 12.4 l. to basis caudal 24.4 l. Length pectoral from base 5; from same base to do. ventrals 5.7 lines.

In life pure silver white to the dorsal line; the dorsal scales brown edged; a vermillion band through anal fin and one through dorsal; the lips vermillion all round the mouth.

This species is as beautiful as the H. chlorocephalus; if not as rich, its tints are much more transparent. Common in the tributaries of the Yadkin River, in Roane County, North Carolina.

HEMITREMIA, Cope.

Genus novum.

Char. Dentition 5—4, with marked masticatory surface. Alimentary canal short, with the usual two flexures. The lateral line one-half wanting, and generally imperfect. First (osseous) dorsal ray adherent. Premaxillary projectile.

This genus is Hybopsis with teeth 5—4, and undeveloped lateral line. perhaps it will be necessary in future to refer H. heterodon and H. bifrenatus to it.

Hemitremia vittata, Cope.

This is a stout species with very short head and obtuse muzzle. The latter is rounded horizontally from the orbits. The mouth is short and oblique; the end of the maxillary does not reach the orbit. Diameter of orbit equal muzzle, 3.5 in head; 1.33 times in interorbital width. Length head 4.2 times to base caudal; depth 4.5 in same isthmus rather wider. The first dorsal ray originates a little behind above the ventrals; scales $\frac{6}{38:\frac{}{4}}$ Radii D. 1. 8; A. E. 7. Length to basis caudal 24.4 lines. Do to basis dorsal 13.2 lines; length pectoral 4.2.

The specimen is alcoholic, and I do not know the colors in life. There is a conspicuous dark shade along the median lateral line, and a pale band above it; above this the whole dorsal region is of a dark color.

This species is from the tributaries of the Holston River, near Knoxville, Tennessee, and was procured by my friend, Prof. Harrison Allen, who submitted the specimen to me for examination.

PHOTOGENIS, Cope.

Proceed. Acad. Nat. Sci., 1867, 163.

49. PHOTOGENIS LEUCOPS, Cope.

Var. *aaaa.* Depth into length to basis caudal fin 6.5 to 7 times; head in same 4.5 times; scales $\frac{38}{2}^{6-7}$ abundant in the French Broad River.

Var. *aaaaa.* Depth into length 5 times; length head into same 4 times; scales $\frac{38}{3}^{5-6}$ color silvery, a double row of black specks on lateral line. Very abundant in the head waters of the Catawba River. This fish, when taken from the water, always sustains a rupture of some of the branches of the ophthalmic artery by which blood is suffused beneath the cornea. The altered condition of pressure on transfer to a rare medium, is no doubt the cause.

Also from the Neuse River, near Raleigh.

50. PHOTOGENIS TELESCOPUS, Cope.

Loc. Cit. 165.

Very abundant in the French Broad River; a variety with large eye in a tributary of the Clinch.

51. PHOTOGENIS LEUCIODUS, Cope.

Loc. Cit. 165.

Abundant in the waters of the tributaries of the French Broad River.

52. PHOTOGENIS PYRRHOMELAS, Cope.

Spec. nova.

This species is in most characters related to the Hypsilepides, and it combines remarkably the characters of the H. cornutus, H. analostanus, and H. diplæmia. Thus it has the head of the first, the form, with milky paired, and black spotted dorsal of the second, and the long anal of the third. As the teeth are without masticatory surface, I refer it for the present to this genus.

The extremity of the muzzle descends obliquely to the mouth, which is itself oblique, the end of the maxillary descending to a line from the anterior margin of the orbit. The mandibular and premaxillary margins are in the same vertical line when the mouth is closed. The diameter of the eye ball enters the length of the head 3.6 times, and 1.25 times in interorbital width. Length of head four times in length, depth about the same. The body is therefore rather deep and compressed. Teeth sharp, hooked, 4.1—1.4. Radii D. I. 8, A. I. 10. V. 8. The extremities of the pectorals barely reach the ventrals, and the ventrals attain the anal. Scales $\frac{31-6}{3}^{6}$; most of them with narrow exposed surfaces, as in typical Hypsilepis. Total length 40 l.; to orbit, 2.8 l.; to origin dorsal fin 16.5 l., to origin caudal 32.7 l.

In coloration this is again one of the finest of our Cyprinidæ. Specimens taken in autumn were steel blue above, the scales darker edged; the belly silver. The muzzle and upper lip to the end of the maxillary, are vermil-

lion; also, the iris above and below the orbit. The dorsal fin has a large black spot on the posterior half; the fin is anteriorly vermillion. The tail has a rather broad black posterior margin, and a wide vermillion crescent following it into the points of the fin; base of the fin pale. Anal and ventral fins with milky pigment.

Small horny tubercles appear on the upper surface of the head in spring, as in the species of Hypsilepis.

In this case I have assigned this species to its genus in accordance with its technical characters, but it is probable that it will be necessary to change the arrangement at some future time,—when the structure of these fishes is better known.

The P. pyrrhomelas is the most abundant fish in the tributaries of the upper Catawba River, North Carolina.

ALBURNELLUS, Girard.

Several species of this genus were obtained, and may be compared with others already known, as follows:

I. Ventral fins extending beyond dorsal, reaching anal.

Scales 5—36—2; dorsal much elevated. A. 8. — A. ALTIPINNIS.

II. Ventrals extending to opposite last dorsal ray; not to anal.

a. Scales above lateral line 5—6.

β. Scales large, lateral line 33.

Orbit large. — A. MEGALOPS.

ββ. Scales smaller, l. l. 38—40.

Scales $\frac{5}{2}$; head smaller, body stouter. A. 8, eye smaller. — A. AMABILIS.

Scales $\frac{5}{2}$; head larger, body slender. A. 10, eye larger. — A. JACULUS.

Scales, etc., as last; eye much larger. — A. ARGE.

aa. Scales above l. l. 7.

Scales $\frac{\frac{7}{11}}{3}$; slender. A. 11. — A. MATUTINUS.

aaa. Scales above l. l. 9.

Rather stout. — A. UMBRATILIS.

III. Ventrals only extending to line of middle of dorsal.

Head 4.5 in length; scales $\frac{\frac{6}{39.}}{3}$ — A. MICROPTERYX.

53. ALBURNELLUS ALTIPINNIS, Cope.

Spec. nov.

This species is much less elongate than such typical forms of the genus as A. jaculus, etc. The head is short, but not wide. Orbit very large, diameter exceeding muzzle, entering length of head 2.75 times, one-third greater than the interorbital width. Head 4.33 times in length to basis of caudal, depth five times in same. Anterior dorsal radii unusually prolonged for the genus, equal just half distance from the base to end of muzzle. D. I. 8. A. I. 9. The pectorals do not quite reach the base of the

ventrals. Total length 26 lines; to basis of dorsal 11 lines; to basis caudal 21 lines.

Color white, a broad lateral silver band punctulated with strong black dots. A black band across operculum to orbit, and black spot on preorbital bone. Top of head to origin premaxillaries black shaded.

Two marked bony ridges connected with the system of mucous tubes, diverge from the apices of the premaxillary bones to the epiotic region on each side enclosing an urceolate interspace.

From the Yadkin River, Roane County, North Carolina.

54. ALBURNELLUS MATUTINUS, Cope.

A compact slender species with small scales. Orbit large, contained 3.5 times in length of head, and scarcely larger than length of muzzle, equal also interorbital width. Length of head contained 4.25 times in total less caudal fin, depth six times in same. Length of first dorsal ray just .33 distance from its base to end of muzzle. Pectorals considerably short of ventrals, ventrals short of anal. R. A. I. 11. Twenty-five rows of scales across dorsal line in front of dorsal fin.

Length 32 lines; to basis dorsal 14.4 lines; to basis caudal 26 lines.

Above olivaceous, edges of scales brown shaded; lateral band plumbeous; sides and below silvery, a dark spot at base of caudal fin. End of muzzle and chin bright rufous.

From the Neuse River, in Wake County, North Carolina. The first species of the genus found in Atlantic waters.

55. ALBURNELLUS MICROPTERYX, Cope.

Journal Ac. Nat. Sci., Phila., 1868, 233.

Several specimens of this species were taken in Coal Creek, a tributary of the Clinch River, Tennessee, and preserve exactly the characters by which this species was originally distinguished from A. jaculus m.

CLINOSTOMUS, Girard.

56. CLINOSTOMUS AFFINIS, Girard.

Jour. A. Nat. Sci., Phila., 1868, 228.

Very abundant in the waters of the Catawba and Yadkin.

STILBE, Dekay.

57. STILBE AMERICANA, Linn.

Common in still and sluggish water of the Catawba, Yadkin and Neuse Basins.

HYBOGNATHUS, Agass.

The species of this genus are few, and have a wide distribution. Those known to the writer are distinguished as follows:

I. Suborbital bones broad, short; speculum on postfrontal region large. Scales $\frac{6}{4}$; eye small, one-sixth of head, twice in muzzle; A. 8.

H. PLACITUS.

Scales 5-39 ½, eye 4.25 to 4.5, less than length muzzle; head wide, entering length 4.66 times; A. 8. H. NUCHALIS.

II. Suborbital bones long, slender; speculum on postfrontal region little marked.

Scales 6—38—4; head 4.75 times in length, wide; eye large 3 times in head, larger than length muzzle; A. 7.

H. OSMERINUS.*

Scales 5-6——36——3-4; head narrow 4.25 times in length; eye large, diameter exceeding muzzle, 3.3 times in head; A. 8.

H. ARGYRITIS.

58. HYBOGNATHUS ARGYRITIS, Girard.

Proc. Acad. Nat. Sci., Phila., 1856, 182. U. S. Pac. R. R. Surv., vol. X, Tab.

This species was described by Dr. Girard, from specimens obtained by the U. S. Explorations for the Pacific Railroad route, from the Milk and Arkansas Rivers. It appears to be very abundant in the Catawba River, North Carolina. Specimens from it cannot be distinguished from those from the Arkansas in the Museum of the Smithsonian Institution.

CAMPOSTOMA, Agass.

59. CAMPOSTOMA ANOMALUM, Raf.

Rutilus Raf., *Campostoma*, Agass.

From the Cumberland, Clinch and French Broad Rivers, west of the Alleghenies and the Catawba River east of them.

CATOSTOMIDÆ.

Prof. Gill proposed to distinguish this group from the Cyprinidæ as a family (in Proc. Acad. Nat. Sci., Phila., 1861, p. 8), basing the latter on the peculiar characters of the pharyngeal bones and teeth. This course has not been followed by subsequent writers, and the character assigned does not appear to me to warrant the proposed separation. I find, however, that while the premaxillary bone completes the superior arch of the mouth in the Cryprinidæ, in the Catostomidæ, those bones form but a slight portion of the same, the maxillary bones entering into it extensively on each side. This feature is evidently of importance sufficient to define the family, and I therefore adopt it as left by Prof. Gill.

*HYBOGNATHUS OSMERINUS, Cope spec. nov.

The characters of this species are expressed in the above table. It is very near the H. argyritis Gir., but has a materially shorter head and smaller anal fin. The head is relatively wider. The preorbital bone is about as long as deep. The mandible very attenuate, and with a slight symphyseal tubercle. End of maxillary not beyond line of posterior nares. Orbit large. D. I. 8, A. I.7. (H. regius has II—9 A., according to Girard.) Total length 31.2 lines; of head 5 l.; to basis dorsal 12.5 l.; to basis caudal 12.7 l. Pectorals and ventrals very short; first articulated dorsal ray 6 lines long. A broad silver lateral band; bright olive above it, pale below it: no black spot on basis caudal. Speculum on postfrontal region small and little visible.

This species is abundant in the Raritan River, New Jersey, in early spring ascending the river with the smelt (Osmerus). Discovered by my friend, Dr. Chas. C. Abbott, of Trenton, who is investigating the ichthyology of New Jersey.

PLACOPHARYNX, Cope.

Genus novum.

Allied to *Ptychostomus*, Ag. The pharyngeal teeth much reduced in number, only seven on the proximal half of the bone, cylindric in form, with a broad truncate triturating surface. These play against a broad crescentic chitin-like shield on the posterior roof of the pharyngeal cavity. Three divisions of the vesica natatoria.

With a great superficial resemblance to *Ptychostomus*, the masticatory apparatus is different from that of any Catostomoid form known to me, and combines peculiarities observed in forms of true Cyprinidæ. The chitin-like shield is found in some of the latter; it is represented in *Catostomus*, *Ptychostomus* and *Carpiodes*, by a narrow and very thin pellicle of the same material, frequently interrupted on the middle line.

I know as yet but one species of the genus.

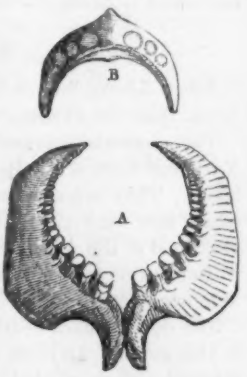
Placopharynx carinatus, Cope.

Species nova.

The physignomy and proportions of this sucker are those of the *Pt. erythrurus* or the "red horse" of the Western Rivers.

The lips are large and plicate, the anterior pendent like that of the *P. collapsus*, the posterior full like that of *Pt. cervinus*. Muzzle vertically truncate. Length of head in that of body four times; depth of body in same 3.66 times; scales 6—41—5. Radii D. XIV, V. 9. A. 7. Free margin of dorsal straight, not elevated anteriorly. Occipital region more elevated medially than in *Pt. erythrurus*, superior ridges well marked, with a special addition characteristic of this species, and of none other with which I am acquainted. This is a median longitudinal frontal ridge, extending from the fontanelle to between the nasal ridges. Only the posterior extremity of this ridge appears in some Ptychostomi. Orbit longitudinally oval, 4.5 times in length of head, twice in interorbital width. Type, fourteen inches in length.

Fig. 2.



Color in alcohol like that of other species, uniform straw or whitish silvery.

The pharyngeal bones of this species are much stouter than those of other species of its own and greater size, *e.g.*, *Pt. aureolus* of eighteen inches, where they are comparatively slight. The exteroposterior ala is twice as wide as the body inside the teeth is deep, and but for its short base and narrowed tip would do for that of a Semotilus. But while there are seven broad teeth without heel or cusp on the basal half, there are at least forty on the distal half, they becoming more compressed and finally like those of other allied genera. There are fourteen with truncate ex-

tremities. The pharyngeal plate has narrow horns directed upwards and forwards, and is thickened medially. It is placed immediately in advance of the opening of the oesophagus. I have but one specimen of this curious species, which I obtained at Lafayette, on the Wabash River, in Indiana.

CATOSTOMUS, Lesueur.

60. Catostomus teres, Mitchill.

Cyprinus teres, Mitch. *Catostomus teres*, *C. communis* and *C. bostoniensis*, Les.

Common in all the rivers of the State and on both sides of the Allegheny water-shed.

61. Catostomus nigricans, Les.

C. planiceps, *Cuv. Val.*

Common in the Clinch, Cumberland and French Broad Rivers.

An especially western species, and abundant, where it occurs.

62. MOXOSTOMA, Rafinesque.

Moxostoma oblongum, Mitch.

Catostomus tuberculatus and *vittatus*, Lesueur. *Labeo oblongus*, Dekay.

In North Carolina, as in Pennsylvania, this species is confined to the sea-board streams. I only found it in the Neuse.

PTYCHOSTOMUS, Agass.

Amer. Journ. Sci., Arts XIX. 88. *Teretulus*, Raf. Cope emend. Journ. Acad. Nat. Sci., Phila., 1868, 235.

The species of this genus are found in the United States, South of New York and East of the Rocky Mountains, including the waters of the great lakes. They are especially numerous in the rivers of North Carolina, which flow into the Atlantic, and constitute one of the peculiarities of that shed of the Allegheny range, as distinguished from the streams of the western slope in Tennessee, where a smaller number of species is found. Wherever Ptychostomi occur they are abundant in individuals.

The development of the lips furnishes important diagnostic indications in this genus. In those most nearly allied to Moxostoma, the inferior lip resembles that of that genus, in being narrower, and deeply incised, emarginate posteriorly forming a figure V with the apex forwards; at the same time the superior lip is very thin, and often narrow. Such species are shorter, and tend to a large development of dorsal fin. Others of this type are more elongate. The more typical forms have a large inferior lip, which is generally produced posteriorly to a square transverse margin. Most of these are more elongate species than the last group. Some species of both are distinguished by their very prominent conic muzzle, and minute inferior mouth, reminding one of the Carpiodes. In one species the surface of the lips is pappillose instead of plicate. In some species the mouth is very projectile, in others scarcely so at all.

Rafinesque proposed a genus *Teretulus* on the characteristic peculiarity of nine ventral radii, belonging to most of the species of this genus. He, however, included species of two other genera. On this account Agassiz, in rearranging the suckers, imposed on it the name standing at the head of this article, regarding the plicate lips as a primary character. I think Rafinesque's name is to be rejected, owing to its ill application; the more as I find two species in which there are ten ventral radii. I adopt that of Agassiz, though I showed, when describing the Pt. cervinus, that the tricellular natatory bladder is a more distinctive feature. This becomes the more obvious now that I have found a species where the lips are turbercular instead of plicate.

The following scheme will render the identification of the species more simple.

A. Lips pappillose, inferior Λ shaped.

Head elongate, muzzle truncate. P. PAPPILLOSUS.

AA. Lips plicate.

a. Inferior lips infolded, Λ shaped.

β. Oblong species; head one-fourth the length.

Eye large; D. XVI; form compressed. P. VELATUS.

Eye smaller; D. XV; compressed. P. COLLAPSUS.

Eye smaller; D. XII; subcylindric. P. PIDIENSIS.

β'β'. Fusiform species; head one-fifth the length.

Muzzle conic; mouth minute inferior. P. COREGONUS.

aa. Inferior lips narrow, crescentic.

Head one-fifth length, muzzle sub-conic. P. ALBUS.

Head long, truncate, ¼; fins white. P. THALASSINUS.

aaa. Inferior lips well developed, truncate posteriorly.

β. Compressed species.

γ. Head 4, 4.5 in length.

δ. Dorsal radii XII.

Stout, elevated; muzzle short, fins crimson. P. ROBUSTUS.

δδ. Dorsal radii XIII.

ε. Ventral radii IX.

Head longer, occipital region flat, muzzle truncate, eye smaller 4.5; scales 5—42—4; scales white. P. ERYTHRURUS.

Head shorter; occipital region convex; muzzle projecting, mouth inferior, eye larger 3.5 in head; scales black at base. P. MACROLEPIDOTUS.

Head elongate, convex with ridges above occiput; eye 4.5 in head; muzzle prominent, mouth inferior; scales white. P. LACHRYMALIS.

εε. Ventral radii X.

Head 4 times; muzzle conic. P. DUQUESNEI.

δδδ. Dorsal radii (XVII) XVIII.

"Eye small; depth 3.25, head 4.3 times in length." P. CARPIO.

γγ. Head five times in length ; occipital region strongly convex.

∂. Ventral radii IX.

D. XIII. muzzle little prominent, dorsal truncate. P. AUREOLUS.

D. XII. Muzzle projecting ; lips large. P. CRASSILABRIS.

∂∂. Ventral radii X.

D. XIII. Muzzle projecting, mouth inferior. D. free border deeply incised. P. BREVICEPS.

∂∂∂. Ventral radii unknown.

D. XIV. Muzzle produced convex, mouth very small, back elevated. P. CONUS.

ββ. Cylindric species.

D. XI, XII. Head one-fifth length ; sides lined. P. CERVINUS.

63. PTYCHOSTOMUS PAPPILLOSUS, Cope.

Species nova.

Body deeper than thick, the dorsal outline not at all elevated. Head elongate not more than one-fourth the length to base of caudal, the orbit small and bordering the frontal plane. Preorbital region most elongate in the genus ; muzzle truncate in profile ; the upper lip hanging free, the lower deeply incised behind so as to be Λ shaped, and with the upper, finely granular, not plicate. The muzzle very projectile, more so than in any species of the genus. The top of the cranium is everywhere plane. Dorsal fin truncate, with XII radii. Scales large, about as in P. COLLAPSUS, Cope, i. e. 6—42—5.

Color everywhere a silvery white, except some blackish shades at the bases of the scales of the dorsal region. The fins, unlike those in most other species, are pure white in life. They obtain one foot in length, and do not exceed one pound in weight.

This species is quite abundant in the Catawba and Yadkin Rivers, in North Carolina, and is highly valued by the inhabitants as an article of food. It is regarded as the best of the Catostomi for this purpose. It is less frequently caught on a hook than some other species, but in the autumn they come on the weirs in considerable numbers ; from these I procured many specimens. The fishermen call it the "Shiner." Its characters are very constant, and not likely to be confounded with those of any of the known Ptychostomi.

Ptychostomus velatus, Cope.

Species nova.

This is a stout species, with a short head, large eye, and more than usually elongate dorsal fin. Scales 5-6——42——5 ; head scarcely 4 times in length ; superior plane nearly flat ; orbit 3.75 times in length of head ; 1.5 times in interorbital width. D. XVI. with straight superior margin ; V. IX. Upper lip pendent. Dorsal outline arched to the first dorsal ray greatest depth 3.2 lines in length (exclus. caudal). Total length 11 inches.

The color of this species I cannot give, as I have not seen it in life; in spirits it is uniform silvery, the dorsal fin dusky.

I know this fish from two specimens which I caught in the Youghiogheny River, in Western Pennsylvania.

64. Ptychostomus collapsus, Cope.

Species nova.

This very abundant fish is in the form of its lips similar to the last. It is stout and short, the head not entering the length (exclus. caudal) quite four times. The dorsal line is somewhat elevated to the first ray of the dorsal fin, the depth entering the length 3.5 times. The eye is smaller than in the *P. velatus*, entering the length of the head 4.75 and 5 times, and the interorbital width 1.75 times. Top of head plane; muzzle moderately prominent, intermediate between P. erythrurus and Pt. conus in this respect, being more compressed than in the last. Mouth small, little projectile, superior lip pendent. D 15, V. 9. Thoracic region with small scales.

The specimens of this species from most of the North Carolina Rivers are rosy on the sides, the larger, light golden; the inferior fins all orange. The specimens from which the above description is taken are small, only a foot long, but I have seen several specimens in the Catawba River, of three and four pounds in weight.

It occurs in the Neuse, Yadkin and Catawba Rivers, in North Carolina, the Clinch River in Tennessee, and I have a specimen from the Wabash River, in Indiana, and three others without locality, but probably from the Western States or Great Lakes. In the Yadkin and Catawba Rivers it is immensely numerous, and is caught on weir traps in the spring and autumn in quantities, and used as food by the inhabitants. It is not as good a fish as the *P. pappillosus* and *P. robustus*, but is not at all to be rejected.

There seemed to be a larger number of smaller specimens in the Yadkin than the Catawba Rivers at the time of my visit. The specimens from the Neuse have the muzzle a little more prominent. Some specimens from the Yadkin possess only XIII and XIV D. rays.

65. Ptychostomus pidiensis, Cope.

Species nova.

A smaller species than either of the preceding, of more cylindric and less compressed form. The dorsal fin is shorter, containing only XII rays. Head elongate, about four and a half times in length exclusive of caudal fin. Muzzle not conic, but truncate. Scales similar to those of the last species. Length about ten inches.

Color light brownish yellow, fins light red.

This fish resembles at first, the *Pt. cervinus*, both in color, form and size. I obtained a few specimens from the traps in the Yadkin River, at the plantation of John Kuntz, and did not see it in any other river.

I took a variety in a tributary stream, characterized by a longitudinal black spot at the base of each scale, giving a handsome longitudinal

striation. (A similar variety of *Hypsilepis analostanus* (q.v.) was taken in the same stream.) Scales 6—44—5. V. IX. A. VII. Head flat above; eye 4 times in head, 1.5 times in interorbital breadth. Dorsal and caudal fins black edged.

66. Ptychostomus coregonus, Cope.

Species nova.

This fish is very easily distinguished by its very small head, with conic muzzle, and elevated arched back, combined with a small size, and other characters.

The head enters the length not less than five times, and is much arched in transverse section posteriorly above. The diameter of the eye is large, entering the head between three and four times; the muzzle is regularly conic, and projects far beyond the mouth. The latter is remarkable for its small size, and lack of projectility; in ordinary individuals it would about admit a pea. The upper lip is not pendent below the front of the muzzle. The shape is broadly fusiform, the dorsal line rising to the fin. It is, nevertheless, more compressed than the species already described. D. XIV constantly.

The ground color is silvery, the scales shaded with leaden above, and with black pigment at their bases, giving a dusky hue to the whole, as is not seen in the species already described, except the *P. pappillosus*. Belly and inferior fins pure white, lacking the red and orange of many others.

This fish never exceeds a foot in length, and is very abundant in the Catawba and Yadkin Rivers. It is caught with the preceding two species and is used for food, but is the least valued of all the species. It is called at Morganton, "blue mullet."

67. Ptychostomus albus, Cope.

Spec. nov.

This large species has the small head of the last, without the small mouth and many of its other peculiarities. The head enters the length not less than five times; muzzle is prominent, but the mouth is less inferior than in Pt. coregonus. The eye, in a specimen sixteen inches long, is relatively larger than in *P. collapsus*, and about as in *Pt. coregonus*. The muzzle is less prominent than in the last named fish, but more so than in *Pt. collapsus*. The mouth is of ordinary size, but the upper lip does not form a free projecting rim as in the latter. The under lip is a narrow crescent following the boundary of the mandible, not folding so as to meet on the middle line as in the species already described.

Dorsal outline a little elevated, rays XIV.

Colors very light; the inferior fins white. In size this species is one of the largest, reaching four pounds and over. It is much valued by the people living in the neighborhood of the Catawba River, North Carolina, as an article of food. They call it the "White Mullet." I have not seen it in the Yadkin or any other river.

68. Ptychostomus thalassinus, Cope.

Species nova.

This fish approaches the *Pt. collapsus*, Cope, in many respects. The head

is elongate, about one-fourth the length (exclusive of caudal fin), and is plane above. The muzzle is not very prominent, nor the mouth smaller than usual in the genus. The lower lip is quite different from that of *Pt. collapsus* in its narrow crescentic form. The eye is similar in size to that of that species. The dorsal line is elevated; dorsal radii XIV—XV. Color sea green above, white below; fins white. Reaches four or five pounds, and still greater weight.

It may be that this fish is a form of the *P. collapsus*, but the different mouth and coloration seem to separate it. Its whole proportions differ from those of *P. albus*. I have only observed it in the Yadkin River, where it is abundant, and used for food.

69. Ptychostomus robustus, Cope.

Species nova.

With this species we commence the most numerously represented section of the genus, in which the inferior lip is large and full, entirely covering the space between the rami of the mandible, and having a transverse or convex posterior margin. In this it resembles the true Catostomi, and diverges from the type of Carpiodes, etc.

In *P. robustus*, we have a species, stout in all its proportions, and with marked coloration; with the gibbous or elevated dorsal outline of *P. coregonus*, it combines the short body of the *Pt. collapsus*. The head is short and deep, the muzzle not prominent, truncate in profile. Eye between four or five times in length of head. Dorsal fin short with straight superior margin, radii XII. Scales as in *P. collapsus*.

Color smoky or clouded above, mingled with golden reflections; sides similar, below yellowish. Dorsal, caudal and anal fins dark crimson. Size large. I examined one of six pounds weight.

This species is distinguished by its form and color, from all the others inhabiting the Yadkin. I did not see it in any other river area. It is highly valued for the table by the people living near the river. With the *P. thalassinus* and *T. erythrurus* var, it is taken in spring-nets. These nets are attached by four corners and suspended to the extremity of a lever whose fulcrum, as high as a man's head, is on the river bank. Bait is thrown on it, and when the fishes congregate, the land end of the lever being suddenly depressed, the suckers do not escape. If fishing were confined to this mode, and the autumn weirs not made too tight, an abundant supply of food from the rivers might be promised the State of North Carolina for future time. But unfortunately, too many of the people with the improvidence characteristic of ignorance, erect traps, for the purpose of taking the fishes as they ascend the rivers in the spring to deposit their spawn. Cart loads have thus often been caught at once, so that the supply is at the present time reduced one half in many of the principal rivers of the State. The repopulation of a river is a very different matter from its preservation, and involves much time, attention and expense. It would be far cheaper for the State of North Carolina to enact laws preservative of this important product of her waters, similar to those in force

in many of our older States. The *execution* of such laws is, however, the important point, and the destruction by officers, of the spring traps and weirs in the Neuse, Cape Fear, Yadkin and Catawba Rivers, every spring, at the time of running of the fishes, would allow of the escape of immense numbers of them, before the traps could be repaired.

70. Ptychostomus erythurus, Raf.

Ichthyologia Ohiensis, p. 59. *Ptychostomus duquesnei*, Agass part. Am. Journ. Sci. Arts., XIX 90. Cope Journ. Ac. Nat. Sci., Phila., 1868, 236.

This species is probably the most widely distributed, as well as one of the largest of the genus.

The form is somewhat compressed, but the dorsal line is not much arched; the head is of medium size, entering the length 4.5 to 4.66 times. The end of the muzzle is nearly vertical in profile. The lips are full, the posterior truncate or openly emarginate posteriorly; the plicate coarse. Eye 4.5 times in length; 1.66 lines in interorbital width. Depth of body three and two-thirds times in length (exclus. caudal.) Top of head nearly plane. Scales 5——42——4. Radii D. XIII, V. 9., dorsal with straight superior outline. Color silvery, rosy and gray above; dorsal caudal and anal fins orange.

The above description is taken from one of several specimens from the Yonghiogheny River, in Western Pennsylvania. I have procured other and similar individuals from the Holston and French Broad Rivers, in Tennessee. It is, as Rafinesque observes, a most abundant sucker in all the rivers tributary to the Mississippi from the East, and is that which is known every where as "red horse." It is the common fish-food of the people, sharing the distinction with the "blue cat," *Ichthaelurus coeruleseens*. It reaches as large a size as any species of the genus, and I have seen them of six and eight pounds. The largest I have heard of, was caught in the French Broad, and weighed twelve.

With various authors, I have formerly regarded it as the *Pt. duquesnei* of Leseuer, but I suspect it to be distinct, as already indicated by Rafinesque. The characters of the latter are pointed out below.

A species resembling the present, as well as the *Pt. robustus*, bears the name of "red-horse," in the country of North Carolina, east of the mountains, but whether the same or not, the present inaccessibility of my specimens prevents me from deciding. A specimen from the Catawba of seven lb. weight had a relatively larger head, and was otherwise stouter than the above described. D. 1.12; scales 6—43—5. The fish is common in that river, and equally so in the Yadkin. Those from the latter have D. XII; muzzle not prominent; head and body rather elongate; shaded with yellow, particularly on sides of head; fins orange. It will be observed that the eastern fish agree in having D. 12 soft rays.

71. Ptychostomus lachrymalis, Cope.

Spec. nov.

This species is quite near the last, and may at some future day be shown to be only a local variety of it, but in this case *Pt. macrolepidotus* must

follow also. Its characters are very similar; our specimen differs in its more numerous scale series, a point in which the *Pt. erythrurus* agrees with all the other species with scarce an exception. I do not know of any genus where the number of scales is so similar in all the species, as in *Ptychostomus*. Scales 7—46—5, in a larger specimen, in a smaller they are 6—44—5. The cranium, however, presents us with the oblique superopercular region and elevated vertex with a ridge on each side, as in the *Pt. macrolepidotus*. The premaxillary spines and nasal cartilage also projects, leaving quite a depression across the muzzle in front of the nares, a feature not seen in *Pt. erythrurus*, and less marked in *Pt. macrolepidotus*. The mouth is quite inferior, but is large and the lips large and thick. The inferior has a slightly concave posterior margin, and the median posterior fissure is stronger than the others. The orbit is smaller than in *Pt. macrolepidotus*, and enters the interorbital space twice. Depth 3.75 times in length. The dorsal outline is gently arched, and reaches its highest point a little in advance of the dorsal fin. The latter has the superior outline but little concave, rays XII in the larger, XIII in the smaller; V. 9.

The scales of this species are as in *Pt. erythrurus*, not black at base; a trace is seen in the smaller specimen. This mark is seen in *Pt. macrolepidotus* and *Pt. crassilabris*, the latter also from the Neuse river. The fins are white.

This species reaches a length of eighteen inches. One like it is sold in the market of the city of Newbern, N. C., with a second species much resembling the *Pt. crassilabris*, but whether identical or not, I cannot be sure, as my specimens were lost.

Ptychostomus macrolepidotus. Lesueur.

Agassiz in Sillim. Amer. Journ. Sci., Arts XIX. 89. *Catostomus macrolepidotus*, Les. Journ. Acad. Natl. Sciences I, 1817, 94 Tab.

Fusiform compressed, the depth entering the length $3\frac{3}{4}$ times; the head short, contracted anteriorly, the occipital region elevated, very convex transversely. Length of head 4.6 to 4.5 times in length; orbit large, diameter 4 to 4 3 times in length of head, and twice in interorbital width. Scales 5—45—5, radii D. XIII; V. 9. The lips are well developed, and the posterior is transverse posteriorly.

The length of the specimen described is about a foot. The color in life including fins, is white, yellow shaded above.

Ten specimens have been compared, all from Pennsylvania and Delaware. Of five from the Conestoga Creek, a tributary of the Susquehanna, two have the parietal, median frontal, and nasal bony ridges very prominent, while in two they are almost without trace. In the former the dorsal radii are XIII, in the latter XII. I cannot discover the sexes of these specimens as they have been eviscerated. In the other five there are several with weak crests, but none with XII D. rays.

In a large specimen from the Wabash River, the only departure from the typical form is the more emarginate inferior lip.

This species is especially abundant in the comparatively sluggish streams

of Maryland and Delaware, and is but little valued for market. It is no doubt the species described first by Lesueur, as it is the only one of the genus seen in the Philadelphia market. I did not meet with it in North Carolina.

Ptychostomus duquesnei, Lesueur.

A specimen of this fish from near Pittsburg, Lesueur's original locality suggests the correctness of the opinion of Rafinesque, that his *Pt. erythrurus* is a different species. The characters are seen in the 10 ventral radii, and the considerably more prominent muzzle, with correspondingly inferior mouth. The scales are also smaller 7—48—7, (to front of ventral). Dorsal fin little incised above, R. XIII. Length of head 4.6 in that of head and body; orbit four times in head 1.75 times in interorbital space. Cranial crests moderate, the parietal region elevated as in *Pt. macrolepidotus*, not so plane as in *Pt. erythrurus*. Depth 3⅔ in length. Lips moderately developed. Dentition as in *Pt. erythrurus*. The coloration in spirits is quite like that of other species, except that the dorsal region is a dark steel bluish, which the other species do not exhibit. Scales without black spot at base.

Length of a moderate specimen from the Youghiogheny River, Pennsylvania, one foot.

Kirtland's description in Proc. Boston Sci. Nat. Hist. V 268, leaves it somewhat uncertain as to whether this species or the *Pt. erythrurus* was before him; his figures resembles the present fish. I should not be surprised to find that his female "red-horse" described as so different from the male, was our *Pt. collapsus*.

Ptychostomus carpio, C. V.

This species differs from its near allies in the more numerous dorsal radii, etc. The form appears to be that of *Pt. erythrurus*. Its habitat is given by the French authors, as Lake Superior, and Günther adds St. Lawrence River and Lake Erie. I have not seen it. The lip characters separate it from *Pt. velatus*.

Ptychostomus oneida. Dekay.

Geological survey, New York, III, 189.

This species is also similar in general proportions to the *Pt. erythrurus*, but has, according to Dekay, more numerous scales and a much smaller eye. Dekay says: seventeen longitudinal rows of scales counted at dorsal fin. Head and body 10 in.; tail 2.; head 2.5 (one-fourth); eye., 4 inch (one-sixth head). Radi D. XIII; V. 9. He does not describe the lips.

Oneida Lake.

Ptychostomus aureolus. Les.

Agass. l. c. 89. *Catostomus aureolus*. Lesueur J. A. N. Sci. Phila. I, 95 Tab.

With this species we enter a series characterized by the relatively small size the head bears to the body, and consequent apparent elevation of the latter. The head enters the length exclusive of the caudal fin, five times.

This species resembles the *Pt. macrolepidotus* Les., more than it does the *Pt. erythrurus*, but the proportionate size of the head is less. In a specimen 8 inches long, the scales are 6—49—4; radii D. XIII, V. IX. The supraoccipital region is much elevated and convex, the interorbital region convex, but without keel. The muzzle is prominent, and separated on the upper surface by a deep transverse depression. The mouth is but little overpassed by the muzzle, and is large. The lips are rather narrow. Eyes five times in length, 2.5 times in interorbital breadth of head.

I do not recollect the colors of this sucker in life; Lesueur states the fish to be orange above, bases of scales darker; inferior fins red.

A single specimen from Saginaw Bay, Lake Huron, has furnished me with means of comparison. It agrees exactly with Lesueur's account of it. The basis of the scales of some dorsal series are blackish. The species is supposed to be confined to the Great Lakes.

Ptychostomus sueurii. Rich.

Catostomus sueurii, Richardson Fr. Journ. 1823, 772. Fauna Boreali Americana III, 118.

This species appears to me to be very near the last, and agrees with it in proportions of head to body, of depth, fin radii, squamation, etc. He says, however, that the muzzle projects an inch beyond the mouth, in a specimen nineteen inches long, which is certainly not the case in the species last described. Hence I suspect it to be distinct, and that it will be found to possess other characters when re-examined. Gunther, (Catal. Brit. Mus.) refers it to the *C. macrolepidotus*, to which it is evidently nearly allied.

From the Fur countries, British North America.

72. Ptychostomus crassilabris, Cope.

Species nova.

This sucker is near the *Pt. aureolus*, but has a more contracted conic muzzle, and smaller mouth; it is also a flatter and more clupeiform fish. Supra-occipital region elevated, convex; orbit 4.2 in length of head, 2 times in interorbital width. Depth 3.75 times in length. Scales large, 5—44—5. D. XII; V. 9. Length of specimen described, one foot.

Color in life silver, above with a smoky shading, and the scales black at the bases. Dorsal fin blackish, inferior fins white. Top of head blackish; a black band from occiput to pectoral fin.

The lips of this species are thick, the lower truncate, but the mouth is very small. In these features it is between *P. conus* and *P. aureolus*. The dorsal fin in the specimen described is elevated in front, the basis being only .75 the first soft ray, in length. The margin is deeply concave. The fewer dorsal radii, as well as the less prominent muzzle, distinguish it from *Pt. conus*.

From the Neuse River, near Raleigh, N. Ca.

Ptychostomus breviceps, Cope.

Species nova.

An elongate species with small head, and very convex occipital region, characterized by the presence of X ventral radii.

Depth .25 the length; orbit 3.75 in head, 1.75 in interorbital width. Cranial ridges not strong. Basis of dorsal five-sixths the anterior height, radii XIII; free margin deeply concave. Body compressed, dorsal line very narrow. Scales 6—45—5. Muzzle short conic, projecting beyond mouth. Latter small, lips short, the posterior well developed, not emarginate.

Color white, yellowish below; scales above with a little black at their bases.

Length of specimen examined, ten inches.

This fish belongs to the basin of the Ohio. I have a specimen from the Yonghiogheny. The number of the ventral radii is very constant in this genus, but if the increased number should prove to be accidental, the general characters of this fish would approximate it to Pt. aureolus.

A peculiarity of the type specimen consists in an additional ray in the anal fin—eight instead of seven in the other species, and the alteration of the third and fifth to perfectly simple, unbranched rays, scarcely attaining the edge of the fin. This may be abnormal.

73. Ptychostomus conus, Cope.

Species nova.

This fish represents the *P. coregonus* in the section of the genus with fully developed lips.

Form flat, with elevated dorsal line, and small conic head. D. radii always XIV. Eye large, mouth exceedingly small, far overpassed by the conic muzzle. The superior regions are smoky and the scales with black bases; below, with the inferior fins, white. Dorsal fin dusky.

The lips of this species are smaller than in *Pt. crassilabris*, though the inferior is similarly truncate behind. The muzzle is much more conic and produced than in that fish. The dorsal radii are more numerous.

Numerous specimens from the Yadkin River, North Carolina, where it is taken in large numbers with *Pt. collapsus*, *Pt. robustus*, etc., but is of less value than they.

74. Ptychostomus cervinus, Cope.

Journ. Acad. Nat. Sci., Phila. 1868, 235, Tab. iii, fig. 4.

This species constitutes a well marked section of the genus, characterized by a cylindric form, the transverse diameter of the body being equal to the vertical. Before describing this species in detail, I may premise that I have found no little difficulty in attempting to identify the *Pt. melanops*, Raf., of Dr. Kirtland's fishes of the Ohio. The figure resembles the *Pt. crassilabris* very closely, but the description of "body full, cylindric," will not allow of the identification. Should the fin formula of *Pt. breviceps* be abnormal, the compressed body and lack of spots point to specific diversity. I had thought the present species intended, but the

figure given by Kirtland precludes the idea, for the *P. cervinus* is in form much like the *Catostomus nigricans*, and has a much less elevated dorsal region than the *Pt. melanops*. It differs also in the form of the dorsal fin, which in that species displays XI XII D. radii instead of XIII. For the present, therefore, I introduce the *Pt. melanops* by name only.

Head of *Pt. cervinus* one-fifth the length, as broad as deep, plane above. Muzzle truncate, low in profile, lips large, the superior pendent. The inferior lip thick, more produced than in any other species, and with a median longitudinal fissure, the plicæ are more or less broken up. Body sub-cylindric, scales large. Dorsal short, radii XII, margin straight. Above yellowish brown, below yellow; fins not red. The dark of the upper surfaces often forming broad transverse shades. After death the colors above become a dark emerald green. This fish never exceeds a foot in length, and rarely attains that size. It exists in great numbers in the Catawba River, but I did not meet with it in the Yadkin or elsewhere. It has a peculiar habit of leaping from the water, whence the fishermen call it "jumping mullet." It is but little valued as food, though many specimens are caught on the weirs.

Also from the Roanoke River in North Carolina and Virginia, and the James in Virginia.

Günther again confounds this species, so well known to the fishermen of the Southern rivers, with the Pt. duquesnei.

CARPIODES, Rafinesque.

Agassiz, Am. J. Sci. Arts, XIV, 74, 1865.

The species of this genus are extensively distributed in the fresh waters of North America, east of the Rocky Mountains. I am not acquainted with any from the Atlantic streams to the eastward of the Delaware, though they may exist, while they are found in the Great Lakes and the tributaries of the St. Lawrence. Agassiz defined this genus as above, and indicated four species, one described by Lesueur, one by Rafinesque, and two by himself. I have not seen specimens from the Eastern waters of North Carolina, though they no doubt exist, while they are also abundant in the French Broad and other tributaries of the Tennessee. My specimens of those from the latter being lost, I give an account of other species known to me. I add five to the four already known.

I. Anterior rays of the dorsal fin very much elevated and attenuated, exceeding or equalling the length of its basis.

a The muzzle very abruptly obtuse.

Anterior suborbital much deeper than long; anterior margin upper lip below orbit. C. DIFFORMIS.

Anterior suborbital similar; upper lip before nares; eye 4.6 times in head. C. CUTISANSERINUS.

Anterior suborbital sub-triangular, longer than deep; upper lips before nares; eye 3.6 times in head. C. SELENE.

aa The muzzle conic, projecting.

Size medium, back elevated. C. VELIFER.

II. Anterior rays shorter, measuring the anterior half or a little more of the base of the dorsal; (muzzle conic or projecting).

D. XXIV. A. VII. Depth $2\frac{1}{6}$ in length; head 4.3 in same; back much elevated, anterior dorsal rays measure to the 15th ray.

C. GRAYI.

D. XXVIII, V. X. A. VII. Depth 2.5 in length; head 4.25 in smae; scales 8–5; short, stout; long dorsal rays measure to 22 ray.

C. THOMPSONI.

D. XXVI–VII, V. X. Depth 3 times in length, head 3.5 times; muzzle elongate conic; eye median, large; anterior D. rays not thickened, nearly as long as base of fin. C. BISON.

D. XXVII to XXX; A VIII; scales 6–5; oblong, long dorsals to 22 ray in adults; depth 2.7 in length, eye small anterior. C. CYPRINUS.

D. XXX A. VII; anterior dorsal rays thickened, osseous, short, reaching 16th ray; head small, 4.5 to 5 times in length; eye small anterior; fusiform, depth 3 times in length. C. NUMMIFER.

In the number of the radii of the ventral and anal fins, the species are not always entirely constant; thus in one, *C. bison* there are VI, in another VII anals. In *C. cyprinus* some have IX and others X ventrals. In young examples of the species just named, the long anterior dorsal rays are longer than in the adult, but not so much so as to be confounded with the long rayed species of section one. The margins of the scales in this genus and Bubalichthys are serrate, their structure thicker than in the Ptychostomi.

Gill has adopted the genera of the Catostomi as left by Agassiz, while Günther rejects most of them. Moxostoma, Ptychostomus and Catostomus I regard as distinct genera of the typical form, to which I add Placopharynx. Of those with finer and more numerous pharyngeal teeth, Cycleptus is distinct in its completely ossified cranium, as I have pointed out in an essay on the Cyprinidæ of Pennsylvania. Bubalichthys is well characterized by the form of its pharyngeal bones, as shown by Agassiz. The remaining Rafinesquian genera, Carpiodes and Ichthiobus are but doubtfully distinct from one another. Carpiodes is the older name, with which *Sclerognathus*, Cuv., Val., may be associated as a synonyme.

Carpiodes difformis, Cope.

Spec. nov.

This species has a remarkably obtuse muzzle, which with the large eye, almost gives it the appearance presented by monstrous perch and carp where the premaxillary bones are atrophied. Viewing the top of the head from a position opposite a point mid-way between the dorsal fin and end of the muzzle, the spine of the premaxillary bone is not visible. In the *C. selene* these spines are very distinctly prominent, in the *C. cutisanserinus* slightly so.

The dorsal outline of this fish is arched, elevated to the anterior dorsal radii, and then regularly descending. The long dorsal rays extended, reach to beyond the origin of the caudal. Lateral line nearly straight,

scales 6——35——4. The end of the pectoral is in line with the origin of the first dorsal ray. Radii, D. XXIV, A. VIII, V. IX.

The head is very obtuse and has a very large eye, beyond whose anterior rim the extremity of the nasals project but a little way. The spines of the premaxillaries project upwards and forwards, but not so far as the line of the nasals, and fail by .25 inch of reaching the line of the inferior rim of the orbits. The anterior edge of the mandible is in line with the anterior rim of the orbit, and the end of the thin upper lip reaches the line of the anterior rim of the pupil.

The diameter of the eye enters the length of the head 3.6 times, and the length of the head the total (exclus. caudal) 4.22 times. Opercle radiate-ridged. Supraoccipital region much elevated, with lateral ridges. Anterior suborbital trapezoid, deeper than long. The size of this species is medium; average length, one foot. The color is uniform brownish golden.

From the Wabash River in Indiana.

Carpiodes cutisanserinus, Cope.

Species nova.

This species is near the last, but present various distinctive features. These may be summed up as follows:

The dorsal fin originates mid-way between end of muzzle and basis of caudal fin—considerably nearer end of muzzle in *C. difformis*. The eye is smaller, 4.5 times in length of head. The spines of the premaxillaries project considerably in advance of the line of the nasal bones, and reach the line of the lower rim of the orbit. The upper lip is much in advance of the orbit, and the end of the same barely reaches the line of the anterior rim of the latter. Scales 7—37—5. Anterior suborbital bone vertical ovate.

The lips are minutely tuberculate. Operculum and suboperculum rugose, former radiate. Long rays of dorsal and anal extending a little beyond the basis of the caudal fin. Head four times in length head and body. Depth 2.6 in the same. Length, a foot; color silvery. In a male in spring, the muzzle and front are covered with closely set small papillose corneous excrescences. Radii D.XXVI, V. X, A. VIII.

From the Kiskiminitas River, Western Pennsylvania.

Carpiodes selene, Cope.

Species nova.

Anterior dorsal outline steeply elevated, also the supraoccipital region, vortex convex above middle of orbit, concave above anterior rim of same, as in the two preceding species. The present fish is intermediate in many ways between the two last, and adds characters of its own. Thus the anterior suborbital bone is longer than in either, longer than high, and narrowed posteriorly. The orbit is large as in *C. difformis*, entering the length of the head 3.6 times, while the muzzle is more elongate than in either. The head is narrowed vertically; the spines of the premaxillaries extend beyond the nasal crests, but do not quite reach the plane of the

lower limbs of the orbit. The premaxillary border is far in advance of the orbit, and the extremity of the maxillary attains the anterior rim of the orbit. Dorsal and caudal radii extended, reach the basis of the caudal; the origin of the first is equidistant between the latter point and the end of the muzzle. Rays; D. XXVI; V. 10. A. VIII. Scales 7—37—5. Color silvery white. Length, a foot. Three specimens of this were taken in the Root River, Michigan, in all probability, though the label which accompanied them has disappeared.

Carpiodes velifer, Rafinesque.

Catostomus, Sp.? Lesueur Journ. Acad. Nat. Sci. Phila. I 110. *C. velifer* Raf. Ichth. Chiensis 56 *Sclerognathus cyprinus* "Val." Kirtland Fishes of the Ohio. Proc. Bos. N. H. S o c. V. 275 Tab. XXII fig. 2 not of Valenciennes.

I have referred my specimens to this species chiefly on the strength of the figure and description of Prof. Kirtland, and from the fact that Lesueur regarded it as so near the *C. cyprinus*, which he would not have done with the *C. cutisanserinus* of the Ohio before him. I had two specimens of the present fish, one of them from the Wabash.

It has a shorter dorsal fin than the preceding, having but XXII rays, of which the anterior two are exceedingly elongate. The prominence of the muzzle is the most distinctive feature; it is conic, the spines of the premaxillaries projecting at an angel of 45° to beyond the nasal crests, and the extremity not reaching the line of the lower rim of the orbit. The extremity of the mandible extends to the nares. Eye 4.25 in length of head. Head 3.75 in length; depth 2.4 in the same. Scales as in the last species. Second suborbital long as deep, trapezoidal. Origin of dorsal .2 nearer end of muzzle than basis of caudal. Length of type specimen ten inches.

Rafinesque says that this species is called skip-jack, from its habit of throwing itself from the water, and sailor, from its elevated dorsal fin which appears above the surface of the water. The first mentioned name is also applied to a clupeoid of the same streams, the *Pomolobus chrysochloris*. Raf. Kirtland says the present species is not much valued as food.

Carpiodes grayi, Cope.

Spec. nov.

In this fish we have the form and proportions of the last group, with the shortened dorsal radii of the succeeding forms.

The origin of the first dorsal radii is nearer the end of the muzzle than the origin of the caudal by one-fourth of its basis. This embraces XXIV radii. Anal radii just to base of caudal. Orbit .25 the length of the head; interorbital width 1 3-5 the former. Occipital region elevated; muzzle much prolonged conic, mouth posterior, as in *C. velifer*. In general this species is quite near the latter; the number of scales is the same, and the proportions quite similar. The orbit is not so elevated, and the long dorsal radii about half as long as those of that species. Length of type eight

inches. Locality not well ascertained, but as it accompanied species of Bubalichthys, it is probably from one of the western States.

Dedicated to my friend, Dr. John Edw. Gray, for many years the energetic director of the zoological department of British Museum.

Carpiodes thompsoni, Agass.

Amer. Journ. Sci. Arts, XIX 75. *Catostomus cyprinus* Thompson, Nat. Hist. Vermont. *Sclerognathus cyprinus* pas Kirtland, Fishes of Ohio, Proc. Bost. N. H. Soc. V. 275.

This is perhaps the handsomest species of the genus, and is distinguished by its stout form, numerous narrowly exposed scales, and little elevated dorsal fin. The eye is small, entering the length of the head 5.2 times, and 2.2 times the interorbital width. The muzzle is more elongate, but not so conic as in the two species last described, and projects far beyond the nasal crests, having an obliquely truncate profile. Hence the end of symphysis mandibuli is much in advance of the line of the nares, and the rim of the upper lip just reaches the line of the orbit.

Dorsal line much arched, origin of first dorsal radii midway between end of muzzle and origin of tail. Scales 8—41—6. V. 10, A. VII. Operculum flat, slightly ridged. Length averaging a foot. Color silvery, with a greenish golden band along the middle of each of the series of scales near the dorsal region, producing longitudinal golden bands.

Specimens from Lake George and Saginaw Bay, Lake Huron.

Carpiodes bison, Agass.

Amer. Journ. Sci. Arts, XVII, 356.

The original description of this species is rather too brief to allow of a perfectly satisfactory determination of my specimens. These are from the Wabash, in Tennessee; those described by Prof. Agassiz are from the Osage, in Missouri.

This species has the general form of the buffalo fish, but has not so elevated a dorsal outline. It is therefore, much less elevated than the Carpiodes above described. It is especially characterized by the elongate form of the muzzle, in which it exceeds any other species of the genus. The profile descends obliquely posteriorly from the end of the muzzle to the mouth, and the end of the mandible is but little in advance of the nares, while the canthus is in line with the anterior limb of the orbit. The lips are well developed for the genus, and delicately longitudinally plicate. The eye is large, the middle line of the cranium falling within its posterior rim; in other species it falls posterior to this point. Its diameter enters the length of the head 4.5 times, and the interorbital width, twice. Scales 7—40—5. Pectoral fin barely reaching line of anterior dorsal ray. Caudal furcate half its length.

In general proportions this fish is a good deal like the European carp. The occipital region is elevated and narrowly convex. The long dorsal ray is almost as well developed as in the species of group first, extending

nearly to the end of the fin in one specimen .75 the distance in another. Color, brownish golden. Length, one foot.

75. Carpiodes cyprinus, Lesueur.

Catostomus do., Lesueur, Journ. Ac. Nat. Sci. Phil. I, 91, Tab. *Carpiodes*, Agassiz, l. c. Günther, Cat. Brit. Mus. VII, 24. *Carpiodes vacca*, Agass., l. c.

This is another elongate species with shorter dorsal radii, and rather large scales. In six small specimens there are 7 rows above the lateral line, and in two young and one adult, six. Length of head $3\frac{1}{4}$ times in length same and body; eye small, .25 times in interorbital width, nearly six times in head in adult of a foot in length, 4.5 times in young of five inches. Muzzle quite prominent, but obtuse. Front scarcely concave between orbits or in front of nasals, (thus differing from most of the other species). End of mandible extending beyond line of nares. Lips faintly plicate. Supraoccipital region elevated, little ridged. Anterior dorsal rays midway between origin of caudal and end of muzzle. Color silvery, dorsal fin black, paired fins white-margined.

Common in the tributaries of the Chesapeake and Potomac, rare in those of the Delaware in Pennsylvania.

C. damalis, Gird., from the Platte R., is very near this species.

Carpiodes nummifer, Cope.

Species nova.

The largest species of the genus, from the Wabash River, Indiana.

The detailed characters have been given in the synopsis of the species. The form is characterized by elongation, and the small proportions of the head. The body is compressed, and the dorsal line elevated to the first dorsal ray, which is considerably nearer the end of the muzzle than the origin of the caudal fin. Its rays are more numerous and the anterior shorter than in any other species here enumerated. The bony and first cartilaginous rays are stouter than in any other species, the latter presents no segmentation on the surface for the basal half.

The orbits are more anterior than in other low-finned Carpiodes, the middle line of the cranium falling .25 inch behind the orbit in a specimen of 20 inches length. Diameter 4.6 in head, nearly twice in interorbital width. Scales 7—36—5. Muzzle short, rather obtuse but projecting much beyond mouth. Symphysis mandibuli extending to nares.

Color of scales an olive silver or nickel color, whence the name nummifer, money-bearer. Sides of head yellow. Length 18 and twenty-four inches at least. Wabash River, Indiana; three specimens.

NOTURUS, Rafinesque.

76. Noturus marginatus, Baird.

From the Catawba and Yadkin rivers.

AMIURUS, Raf., Gill.

This genus is by far the most numerously represented by species among the Siluroids of the United States. Twenty-five are known to the writer, and several others have been described which are not satisfactorily distinguished. Besides the United States, China is included in the range of the genus. In North America they are a most noticeable feature of the ichthyological fauna of the Eastern Coast Streams, abounding there in individuals and species, far more than in the tributaries of the Mississippi, where Ictalurus is the prevailing form. The tributaries of the Great Lakes furnish another resort for them, and the rivers of Texas, according to Girard, also abound in them. This distribution in relation to Ictalurus is to be found in the fact that they are lovers of mud and sluggish waters, while the latter genus prefers running streams and rivers.

The species of Amiurus fall into four sections as follows:

I. Caudal fin rounded or truncate when spread open.

A The anal radii few, 17–22.

a Body slender, depth 1–8 length.

Anal radii 17; eye rather large. A. PLATYCEPHALUS.

aa Body stouter; depth 1–5 or less length.

β Lower jaw longer than upper.

Anal radii 20, its basis 5.5—6. times in length; head narrowed anteriorly, body not shortened. A. DEKAYI.

A. 22, head broad, body short. A. ÆLURUS.

β,β Upper jaw equal or exceeding lower.

* Anal radii 17. A. PULLUS.

** Anal radii 19–22.

† Ventral radii 8.

Head width 4.5 to 4.66 times in length; diameter eye 4.5 times between orbits; depth 3.75 in length, beards rather short, humeral process smooth. A. NEBULOSUS.

Width head four times in length, depth 3.66 times; eyes 4.5 between orbits; colors light; beards as above. A. CATULUS.

Width head 4 times in length; eye 4; other characters as above; colors dark. A. CATULUS, var.*

†† Ventral radii 7.

Eye larger, 3.75 times into interorbital width; head narrowed, width 4.66 times in length; black. A. MISPILLIENSIS.

AA The anal fin longer, the radii 24–8.

To this group belong A. cupreus, Raf., A. cupreoides, Gird., A. atrarius, DeK., A. catus, Linn, A. nigricans, Les., A. cœnosus, Rich'n, A. felinus and A. antoniensis of Girard.

II. Caudal fin furcate or strongly emarginate.

A Anal fin with few radii, (19—22).

a Caudal fin merely emarginate.

* I refer a specimen which I took at Poughkeepsie on the Hudson River, to this species.

Head less than one-fourth length. A. 20; eye 4.5 times between orbits; dorsal nearer adipose fin than muzzle. A. CONFINIS.

Head as above; orbit 4 times between orbits; A. 23; dorsal nearer muzzle than adipose fin. A. HOYI.

aa Caudal furcate.

Width of head from 4.6 times in length; eye large, 3 to 5 times in interorbital space; barbels long; caudal fin deeply forked.

A. LYNX.

Head very wide, width 3.6 times in length; eye six times between orbits, barbels very short, caudal not deeply furcate.

A. LOPHIUS.

AA Anal fin large; radii 24.5.

Caudal emarginate; pectoral spine not denticulate; barbels reaching gill opening; head wide as long. A. BOREALIS.

Candal deeply furcate; head narrow, pectoral spine dentate, barbels to end of humeral process. A. NIVEIVENTER.

Of other species of the genus, I have omitted A. puma Gird. A. natalis Les., and A. felis Agass, all belonging to section I, owing to the imperfections in the descriptions. *A. albidus* Lesueur, is, I think, founded on adults of A. nebulosus Les. *A. obesus* Gill of which I have examined numerous specimens from Minnesota, two from the Miami, Ohio, and one from the Kiskiminitas River, in West Pennsylvania, I cannot distinguish from A. catulus Girard (U. S. Pac. R. R. Rept. X). Of species adopted, A. catulus Girard, may be found eventually to be varieties of A. nebulosus. The A. mispilliensis, A. lophius and A. niveiventris, are now described for the first time.

77. AMIURUS PLATYCEPHALUS, Girard.

Proc. Ac. Nat. Sci. Phila. 1859, 160.

This well marked species approaches nearer the genus Hopladelus than any other Amiurus in its elongate, flattened body and head, and in the large number (11) of its branchiostegal radii. It abounds in the Catawba and Yadkin Rivers, where it is justly valued as an article of food.

Amiurus mispilliensis, Cope.

Spec. nov.

This species is related to the common *A. nebulosus*, but has a narrow muzzle, larger eyes and a ventral ray less than any other species of the section. Width of head 4.66 times in length; eye 3,25 times between orbits, maxillary beard extending beyond base of pectoral fins. Pectoral spine dentate, dorsal spine smooth. DI. 6; V.1.6; A. 21. Above entirely black; below, white anterior to anal fin. The mental barbels blackish. The maxillary barbels extend to beyond base of pectoral fin, and the mentals to the branchiostegal margin. Entire length 8 in.; depth 1 in. 8 lines.

I took this specimen in the Mispillion Creek, a sluggish stream in the southern part of the State of Delaware. It doubtless occurs in similar streams in "the Peninsula."

78. AMIURUS LYNX,* Girard.

This is a variable species in the size of the orbits and width of the head. In the younger of six inches in length, the diameter of the former is contained in the interorbital space three times; in specimens of 9.5 inches four times; up to this size the width of the head enters the length without the caudal 4.5 times. Between this size and eleven inches the width of the head varies from 4.5 to four times; the orbit being one-fifth the frontal width in those of larger size. This is the greatest relative width of head I have seen in this species. The upper jaw always projects below the upper, the humeral process is always rugose and swollen proximally, and the maxillary barbels pale edged below.

The younger forms described, are the *Ictalurus kevinskii* of Stauffer, (Mombert's History of Lancaster County, Pa., 1869, 578). The following description applies to such.

It has the narrow head, large eye and furcate tail of *Ictalurus*. The dorsal spine is nearly smooth, other rays 6; A. 22; V. 8; C. VI—17—VII. The depth enters the length times. The largest specimen of this species I have seen does not exceed eight inches in length. The color above is a lively brown, sometimes tinged with purple; sides silvery, belly silver white.

The larger form with relatively smaller eye is *I. macaskeyi*, Stauffer, of the same work. The same form I took in the Mispillion Creek, Delaware. It differs from old examples of the latter in its more slender form, the width of the head entering the length 4.66 times between orbits; barbels and color as in *A. lynx*. Specimens intermediate in character between this and the wider-headed form served as Girard's types. They were from the Potomac. Two specimens in my possession from that river have the with head 4.25 times in length, eye 4—4.5 times between orbits; long maxillary, short mental barbels; dorsal nearly equidistant between muzzle and adipose; humeral process swollen, rugose.

One specimen from the Susquehanna exhibits the width of the head one-fourth the length, as above mentioned. This renders the distinction of Girard's *A. vulpeculus*, questionable, since the only essential characters he mentions are the following:

Head 4 times; orbit $\frac{1}{4}$; caudal 6.5 times in length, dorsal nearer muzzle than adipose fin.

I have seen many specimens of this cat-fish from the Conestoga Creek, from the Susquehanna, and from the Delaware, in Pennsylvania.

Some specimens which I obtained at Newberne, on the Neuse River, were lost; but I suspect them to have been this species. As it is common in the James River, it probably occurs also in the Roanoke.

Amiurus lophius, Cope.

Species nova.

This, perhaps the largest species of the genus, is distinguished by the

* In Origin of Genera, 43, I state that the *Gronias nigrilabris* Cope resembles the *Amiurus lynx* most closely among the *Amiuri*. This is an error; the comparison should be made with *A. nebulosus*, from which the form of the anal fin, short barbels, etc., distinguish it.

greater width of its head, and the gape of the mouth, together with the decided but shallow furcation of the caudal fin. The barbels are considerably shorter than in any other species of the fork-tailed section.

Head and dorsal region very flat, the width of the former contained 3.5 times in the length of the body and head, and the length of the same entering the same three times. The depth at the first dorsal ray, enters the same 5.4 times. That ray is exactly intermediate between the end of the muzzle and the posterior margin of the base of the adipose, having thus a more posterior position than in A. lynx, where it measures the middle of a line terminating at the anterior base of that fin. The free extremity of the adipose is in line with the same of the anal. Radii D I. 6; A. II. 19; V. 8. The eye is small, its long diameter entering the length of the head, measured on the middle line above, seven times, and six times in interorbital space. Pectoral spine weakly; dorsal not, serrate. Humeral process strongly rugose to near extremity.

Maxillary barbel reaching two-thirds to three-fourths the distance from its base to the upper part of the branchial slit, the outer only half way to the branchiostegal margin, the inner three-fourths the length of the outer. The extremity of the muzzle is regularly rounded, the upper jaw projecting a little beyond the upper. Branchiostegal rays nine. Total length eighteen inches; length dorsal spine 18 lin.; do. pectoral spine 18 lin.; do. basis of anal 35 lin.; width of head 53 l.

Color above brown; lower surfaces, including lower lip, (yellow or) white in alcohol; mental beards white.

This species is nearest the A. lynx, Girard, which inhabits the same rivers, but is readily distinguished as above pointed out, and in additionally, by the shorter barbels and lower body. In the width of its gape it exceeds any other North American cat-fish, and will allow of a remote comparison with Lophius in this respect.

I obtained three specimens in the Washington, D. C. market, which came from the lower course of the Potomac river. It occurs in the other tributaries of the Chesapeake Bay, and I think I have seen it in the market of Baltimore. I have not yet observed it in Philadelphia. In the former cities it is deservedly esteemed for the table, and is more valuable than the *A. lynx* and *A. nebulosus*, on account of its superior size.

The last named fish is sold in Philadelphia and neighborhood. It often attains a foot in length. I cannot distinguish the *Pim. albidus*, Lesueur. Pale and piebald varieties of the fish occur.

79. Amiurus niveiventris, Cope.

Spec. nov.

This fish presents a great contrast to the last, resembling in fact the *Ictalurus cærulescens*, Raf., in its slender proportions.

Width of head 4.75 times in length, exclusive of caudal fin. Orbit nearly four times into interorbital width. Depth 5.22 in length as above. Dorsal spine three inches from end muzzle, 3.5 inches from origin adipose fin; its posterior margin with a concealed serration. Pectoral spine strongly

serrate. Radii D I. 6; A. 24; V. 8. Maxillary barbel to near end of humeral process; latter very rugose to near extremity. Outer mental barbel to branchiostegal margin. Br. rays ix.

Color above blackish, sides silvery leaden blue; below, including margin of upper lip and outer margin of maxillary barbels, pure white. Fins edged with dusky. Length of specimens 8.5 inches.

From the Neuse River, N. Ca.

In this species, as in all the fork-tailed Amiuri here described, the lower lobe of the caudal fin is wider than the superior. The young of these species, at least in and *A. lynx*, are much more silvery than the adult, as is the case with some of the Ictaluri.

In concluding my observations on this genus, I may add that I took A. cupreus in the Clinch River, in Tennessee.

ICTALURUS, Raf.

Gill emend.

80. Ictalurus cœrulescens, Raf.

This species abounds in the French Broad and other tributaries of the Tennessee, as it does in those of the Ohio. It is everywhere much used as food, though in my estimation inferior to the large Amiuri of the East, for though the flesh is whiter, it is drier.

SALMO, Linn.

81. Salmo fontinalis, Mitch.

This species is found in the rapid streams in which the tributaries of the Tennessee and Catawba Rivers head, in the highest tracts of the Allegheny Mountain Region. I only took them in one of the heads of the French Broad, where the size was much inferior to that of trout from similar localities in Pennsylvania. The experience of other fishermen in this respect was similar to my own. According to Dr. Hardy, a naturalist long resident in Asheville, well known to the old generation of students South and North, this fish occurs in the headwaters of the Chattahoochee, on the south slope of the Alleghenies, in Georgia. This is the first authentic instance of its occurrence in any water flowing directly into the Gulf of Mexico, with which I have met. From the habits of the species it is hardly to be looked for in any other of the Gulf streams eastward of the Mississippi. According to Dr. Peck, of Mossy Creek, Tennessee, it is not found in the Cumberland Mountains. I did not find it there in the heads of the Cumberland or Clinch.

OSMERUS, Artedi.

Although I am not informed as to the occurrence of any species of this genus on the coast or in the rivers of North Carolina, I introduce it here for the purpose of illustrating some species which have been placed in my hands by my friend, Dr. Chas. C. Abbott, of Trenton, N. J. These were procured and forwarded to him at his request, by Chas. G. Atkins, the efficient Commissioner of Fisheries of the State of Maine, whose authority

is here given for the notes on their habits and places of abode, appended. Interest attaches to the fact that the greater part of the fishes are derived from the fresh waters of that State, and that species of this genus, like those of the other Salmonoid genera, Coregonus and Salmo, are proven to have a lacustrine distribution in the northern part of the United States.

Land-locked Osmeri occur in the lakes of Norway. According to Professor Esmark of Christiana, they are found in Lake Mjosen, which is 500 feet above the sea, and discharges into it by a stream which has a very high fall; also in Nors Vándsjö, near the town of Moss, and in the Stinksild.

I find three species among our lake smelt, as follows:

Eye large, one-third length of head; head short, 4.25 times in length; scales, l. long. 66; l. transv. 10. O. SPECTRUM.

Eye smaller, 4.5 times in head; head shorter, 4.75 in total; scales smaller, l. long. 68; l. transv. 16. O. ABBOTTII.

Eye 4—4.25; head 4, longer; scales, l. long. 65–7; l. transv. 13 (14). O. VIRIDESCENS.

Osmerus spectrum, Cope.

Species nova; smelt of Wilton.

Established on two specimens sent from the above locality in Franklin Co., Maine. Form slender, the head short, with remarkably large eye, and short mouth and maxillary bones. Mandible prominent when closed, as in O. viridescens, the end of the maxillary bone not extending beyond the line of the middle of the pupil. Both the length of the muzzle and the interorbital width are considerably less than the diameter of the orbit. The form of the body is more slender than in the *O. viridescens*, the depth entering the length without caudal fin, 8.33 times. Radii D. 10. A. 1. 15. V. 8. The pectorals extend $\frac{2}{3}$ the distance to the base of the ventrals. Length of a medium sized specimen, 3 in. 6 lin. Scales in about as many transverse, but several fewer longitudinal series than in the other species.

Color probably translucent in life, a silver band along the upper part of the sides. Side of head and operculum silver. Top of head, middle dorsal line and caudal fin so thickly punctate with black as to be colored.

Wilton Pond is near the head of the south-west branch of the Kennebec River in S. W. Maine. The characteristics of this species, according to Commissioner Atkins, are seen in specimens of larger size than those here described, which were taken in breeding condition.

Osmerus abbottii, Cope.

Species nova.

This fish is in general characters more like the O. viridescens than the last; it is similar in the size of the orbit and posterior prolongation of the maxillary bone, but the scales are more numerous and the head is shorter. Like the last, it is considerably smaller than the common smelt.

The depth enters the length without caudal fin, seven times; the head the same, 4.75 times. The orbit is less than the length of the muzzle, and scarcely equal to the interorbital width. The maxillary is delicately

toothed, and reaches the line of the posterior margin of the pupil. The pectoral measures half the distance to the base of the ventral. There are five specimens of this fish, which measure about four inches in length, and they are stated in the accompanying notes to be of medium size. The colors, like those of *O. spectrum*, are darker than those of *O. viridescens*, in spirits. The median line above is dusted with black, and the lateral scales, in several specimens, bordered with the same. Fins blackish, especially the base of the caudal. From Cobessicontic Lake, in Kennebec Co., in Southwest Maine.

According to Commissioner Atkins, this species spawns immediately after the ice disappears, and instead of running into swift brooks, like the varieties of *O. viridescens*, hereinafter described, lays its eggs on the borders of meadows. The specimens described were taken in breeding condition at the breeding season.

As I owe the opportunity of describing these interesting Osmeri to my friend Dr. C. C. Abbott, I dedicate the present species to him.

Osmerus viridescens, Mitchill.

Osmerus sergeanti, Norris. Proceed. Acad. Nat. Sci. Phila., 1868, 93; loc. cit., 1861, March.

Two localities furnish specimens of land-locked smelt, which I can only distinguish from those of salt water by color. The first from Lake Messalonskee, Kennebec Co., have a yellowish color on the sides, and black dorsal line, top of head, chin, and edges of lateral scales. The specimen is 14 inches long, said to be of medium size, therefore exceeding the average of the O. viridescens seen in Philadelphia market, and considerably larger than the *O. abbotti* and *O. spectrum*. They are called the Belgrade smelt.

Commissioner Atkins states that between the 10th and 20th of April, while the lakes are still covered with ice, this fish runs up into the brooks and lays its eggs by night, the eggs adhering to grass and stones. The spawning is complete always before the ice breaks up in the lakes. The temperature of the brooks is from 32° to 40° Fahr.

The second locality is Cochnewagn Pond, Kennebec Co. Specimens of "medium size" are smaller than the sea smelt from the mouth of the Kennebec, and larger than those of *O. abbottii*. They are generally similar to the last variety. These the notes state, breed later by 25 days than the last; that is, 12 or 15 days after the ice disappears, the temperature of the water being 43° to 45°.

The breeding season of the O. abbottii intervenes between those of the above varieties.

Commissioner Atkins says that the majority of the lakes of Maine contain smelt of some kind, and that he frequently finds smelt in the stomachs of trout from these lakes.

ANGUILLA, L.

Species not identified, very abundant in all the Atlantic waters of North Carolina (82).

GANOIDEA.

Lepidosteus osseus, L., occurs in the Yadkin and other eastern rivers of the State, and probably *L. huronensis* in the French Broad, as I have specimens of it from near Dandridge, E. Tennessee. *Polyodon folium* (*Spatularia*) ascends the same river to near Asheville, N. Ca. Various species of *Accipenser* abound in the Atlantic rivers, while descriptions of a fish called "Black fish" or "Brindle fish," found in the Neuse River, induce me to believe that *Amia* occurs there (83–7).

ON THE GEOGRAPHICAL DISTRIBUTION.

The table appended, shows readily the characteristics of the faunæ of the four rivers of the State examined, though many species are no doubt omitted from each, certainly nearly all the larger ones, which I had not facilities for procuring.

The differences between the ichthyologies of the streams on opposite sides of the Allegheny shed, are rather greater in this State than in Virginia; the mountains here constituting a much more important topographical feature, both as to elevation and number of ranges.

The following points distinguish the two kinds of waters:

The western presents greater abundance of Percoids allied to Etheostoma, of Uranidea, and is the exclusive range of Ambloplites, Micropterus fasciatus, and Polyodon.

On the East, the Catawba and Yadkin are peculiar in their poverty in Etheostomine Perch, and the absence of the forms just named, while the extraordinary development of Catostomidæ, and abundance of Amiurus, Anguilla, and Esox, strike at once the naturalist who travels and collects from one to the other. The Neuse adds to these peculiarities a greater affinity to the more northern streams of Maryland and New Jersey, in the occurrence of Enneacanthus, Aphredodirus, Moxostoma, and Hybopsis amarus. Its pike and Centrarchus are of the South Carolina type.

After a similar investigation of the rivers heading on opposite sides of the Alleghenies of S. W. Virginia, I came to the following conclusions:

I. That after deducting species generally distributed, certain remain which occur in streams separated by high ranges of mountains.

II. That the distribution of species is not regulated by community or difference of outlet, rivers having diverse discharges having sometimes more in common than those having the same destination.

As regards the first, the present investigations are confirmatory. While nearly all the Percidæ, Cyprinidæ, and Catostomidæ, and all the Siluridæ of the French Broad River, differ from those of the East, we have the following common to both sides of the range:

Pœcilichthys flabellatus.
Micropterus nigricans.
Photogenis leucops.
Compostoma anomalum;

All species of pretty wide distribution. A peculiarity of distribution is

the occurrence of the Photogenis leucops, confined in Pennsylvania to the heads of the Ohio, and in Virginia to the Kanawha, not only in the Catawba, but in the Neuse. In further illustration, I append a list of species from the South Fork of the Cumberland, in the Cumberland Mountain region, near Kentucky.

Micropterus fasciatus.
Ambloplites rupestris.
Lepomis nitidus.
Percina caprodes.
Etheostoma blennioides.
Pœcilichthys coeruleus.
" camurus.
" sanguifluus.
Hyostoma cymatogrammum.
" simoterum.
Ptychostomus erythrurus.
Catostomus nigricans.
Semotilus corporalis.
Ceratichthys biguttatus.
Hypsilepis cocogenis.
" galacturus.
" ardens.
Alburnellus micropteryx.
Hybopsis longiceps.
Photogenis telescopus
Campostoma anomalum.

Twenty-one species.

Although separated from the waters of the French Broad by the highest ranges of the Cumberland Mountains, and flowing to the North, while the former flow to the South, there is no important difference between their fish inhabitants observable. The difference as compared with the case of the Catawba River, has reference in part to the difference in elevation of the mountain ranges separating them. Those of North Carolina rise to 6740 ft., while according to Prof. Safford, the highest point of the Cumberland is only 3000 feet.

Two curious points in the above list may be observed, viz: the occurrence of Hypsilepis ardens, and Hybopsis longiceps; species which I only found in the James and Roanoke in Virginia, and not in the Western waters, and which, while they occur in the Cumberland (the H. longiceps in the Clinch also) I did not find in the State of North Carolina!

Mimetic Analogy. A curious case of this occurred to me in three species of fishes which I took in a small tributary of the Yadkin River, in Roane Co., N. Ca. Among several others there were varieties of the widely distributed species, Chænobryttus gillii, Hypsilepis analostanus, and Ptychostomus pidiensis, (each representing a different family) which differ from the typical form of each in the same manner, viz: in having the back and upper part of the sides with longitudinal black lines, produced by a line along the middle of each scale. This peculiarity I have not observed in these species from any other locality. Until I had examined them I thought them new species.

The only other species presenting such marking in the Yadkin River, is the large perch, the Roccus lineatus. According to the theory of Natural Selection, a resemblance to this well-armed species might be of advantage to the much weaker species in question, yet the same species coexist in other rivers without presenting the same mimicry.

French Broad.	*Catawba.*	*Yadkin.*	*Neuse.*
			Perca flavescens.
Stizostedium americanum, salmoneum.			
	Etheostoma maculatum.		Etheostoma nevisense.
Hypoholus aurantiacus.			
Poecilichthys zonalis,			
flabellatus,	Poecilichys flabellatus, var.		
vulneratus,			
rufilineatus.			Poecilichthys vitreus.
	Boleosoma maculaticeps.	Boleosoma maculaticeps.	Boleosoma maculaticeps.
Hyostoma cymatogrammum.			
simoterum.			
Micropterus fasciatus,			
nigricans.	Micropterus nigricans.	Micropterus nigricans.	Micropterus nigricans.
			Pomoxys hexacanthus.
			Centrarchus irideus.
Ambloplites rupestris.			
	Chænobryttus gilli.	Chænobryttus gilli.	Chænobryttus gilli.
			Enneacanthus guttatus.
	Lepomis rubricauda.	Lepomis rubricauda,	Lepomis rubricauda.
Lepomis megalotis,			
notatus.		Lepomis purpurescens	
	Pomotis maculatus.	Pomotis maculatus.	Pomotis maculatus.
Amblodon.			
Uranidea carolinæ.			
			Aphredodirus sayanus.
	Esox affinis,		Esox affinis,
	ravenelii.		ravenelii.
Salmo fontinalis.	Salmo fontinalis.		
	Stilbe americana.	Stilbe americana.	Stilbe americana.
Semotilus corporalis.	Semotilus corporalis.	Semotilus corporalis.	Semotilus corporalis.
Ceratichthys biguttatus,	Ceratichthys biguttatus,	Ceratichthys biguttatus,	Ceratichthys biguttatus.
	labrosus,		
hyalinus.	hypsinotus.	hypsinotus.	
Rhinichthys lunatus,.			
Hypsilepis coccogenis,			
galacturus,			
cornutus, var.			Hypsilepis cornutus.
	Hypsilepis analostanus.	Hypsilepis analostanus.	analostanus.
Hybopsis spectrunculus.	Hybopsis amarus,		Hybopsis ? amarus.
	niveus,		
	chlorocephalus.	Hybopsis chiliticus.	

Photogenis leucops, telescopus, leuciodus.	Photogenis leucops.		Photogenis leucops.
	pyrrhomelas.		
? Alburnellus micropteryx.	Clinostomus affinis.	Alburnellus altipinnis. Clinostomus affinis.	Alburnellus matutinus.
Campostoma anomalum. Catostomus teres, nigricans.	Hybognathus argyritis. Campostoma anomalum. Catostomus teres.	Catostomus teres.	Catostomus teres.
	Ptychostomus cervinus.	Ptychostomus conus.	
Ptychostomus erythrurus.			Ptychostomus crassilabris, lachrymalis.
	albus, coregonus,	robustus, thalassimus, coregonus, pidiensis,	
	collapsus, papillosus.	collapsus, papillosus.	Ptychostomus collapsus.
Carpiodes, sp. Ichthælurus cœrulescens. Hopladelus olivaris.			Moxostoma oblongum.
	Amiurus platycephalus. Noturus marginatus.	Amiurus platycephalus. Noturus marginatus.	Amiurus niveiventer.
Polyodon folium.	Anguilla.	Anguilla,	Anguilla,
		Accipenser.	Accipenser.
Lepidosteus huronensis.	Lepidosteus. Petromyzon.	Lepidosteus osseus.	? Amia. Lepidosteus.
37 species.	35 species.	27 species.	32 species.

Stated Meeting, August 19, 1870,

Present, four members.

Vice President, Prof. J. C. CRESSON, in the Chair.

A letter of acknowledgement was received from the Royal Society of London.

Donations for the Library were received from the Societies at Moscow, Offenbach, Bonn, Strasbourg, Lausanne, Salem and Worcester; the Academies at St. Petersburg, Copenhagen, Vienna, and Chicago; the Observatory at St. Petersburg; the Geological Societies at Vienna, Berlin and Florence; the Hospital at Rome; the Royal and Zoological Societies in London; the Royal Society in Dublin; the Oriental Society, and Yale College at New Haven; the Franklin Institute, and Medical News at Philadelphia; the Freedmen's Bureau and Howard University; Herr Dümichen of Berlin; Sig. Dora d'Istréa of Athens; Dr. Andrews of Chicago, and Mr. Edmund Quincy of Boston.

The death of Mr. Samuel V. Merrick, a member of the Society, was announced by Prof. Trego, as having occurred at Philadelphia on the 18th inst., in the 70th year of his age. On motion, Dr. D. R. Goodwin was requested to prepare an obituary notice of the deceased.

The death of Sir James Copeland, M. D., a member of the Society, was announced as having taken place in London, July 14, in the 77th year of his age. Dr. Pepper was appointed to prepare an obituary notice of the deceased.

Prof. Cope communicated a paper entitled "Eighth Contribution to the Herpetology of Tropical America." (See Proceedings, below.)

Prof. Cope communicated a paper entitled "Contribution to the Ichthyology of the Marañon." (See Proceedings below.)

Prof. Cope communicated certain statements concerning *Liodon perlatus*, Cope; and the results of his studies of the Crania of the orders of Reptilia and Batrachia recent and extinct.

Prof. Cope stated that he had been acquainted for some time with a Mososauroid reptile from the white rotten limestone of Alabama, and had formerly thought it to be the *Mososaurus brumbyi*, of Gibbes. He was satisfied of the error of this determination, and as the hæmal arches of the caudal vertebræ were not co-ossified, he referred it to the genus Liodon, under the name of *L. perlatus*. A dorsal vertebra had been already described in the Synopsis of Extinct Batrachia and Reptilia of North America, Trans. Amer. Philos. Soc., 1869, 198.

Prof. Cope communicated some results of his studies of the structure of the crania of the orders of Reptilia and Batrachia, recent and extinct. He explained the characters of the Ichthyopterygia as follows:

The *quadratojugal* present (squamosal of Owen, Anatomy of the Vertebrata); *postorbital* (of Owen) present.. The *squamosal* (supratemporal of Owen) extending over the inner side of the parieto-squamosal arch so as to conceal the parietal portion of it, to the anterior part of the temporal fossa, and in contact with its fellow of the other side. It sends down a columella to the pterygoid. It extends also for a remarkable distance downwards behind the osquadratum. ?*Opisthotic* present. A distinct element exists behind the quadratum, which he thought might be the *suprastapedial*, otherwise called the incus, or hyomandibular, according to Huxley. The pterygoid prolonged backwards and expanded, in contact with the basi-occipital, and extending from it to the quadratum. The posterior pair of elements of the superior face of the cranium being determined to be squamosals, the interpretation of the anterior elements becomes simple. The rhombic element with fontanelle is parietal (frontal of Owen Anatomy of Vertebrata), and the preceding pair are the frontals (nasals, Owen). The true nasals were shown to lie at the proximal end of the nares.

The structure of the suspensorial region in the Anomodont, Lystrosaurus, was next pointed out. In this order there is no quadratojugal arch, and the zygomatic arch contains a very small postorbital. The *squamosal* has an extraordinary development, and extends on the parieto-quadrate arch, and on the inner side of the temporal fossa on each side of the parietal. The *parietal* is not so far concealed as in Ichthysaurus, but its posterior-lateral process may be seen wedged in between the squamosal and the thin, plate-like opisthotic, which lies external to the supraoccipital on each side. The *opisthotic* is the parietal of Owen, and the parietal branch of the squamosal is the mastoid of the same author.

This branch in Ichthyosaurus and Lystrosaurus is continuous with the zygomatic portion of the bone, though another element might have been originally coössified with it. The posterior portion of the squamosal is prolonged remarkably, it is applied to the posterior face of the quadratum, and extends to its articular extremity. The *quadratum* is a small bone of a plate-like form, in contact with the squamosal above and the ?proötic inwardly and anteriorly. *Suprastapedial* not distinguished. The parietal branch of the squamosal sends down a *columella* to the pterygoid.

The *proötic* is a distinct though small bone, below and in front of the squamosal. The presphenoid is plate like, and much as in the Crocodilia.

Prof. Cope thought that the Anomodontia, one of the earliest (Triassic) types of Reptilia are one of the best examples of a generalized group among the vertebrata. Thus the structure of the posterior part of the Cranium is largely that of Ichthyopterygia, and partially that of Lacertilia; of the oral parts of the cranium, the proötic and mandible, of Testudinata. The vertebral characters are partly those of Ichthyopterygia, and the sacrum and rib articulations those of Dinosauria. The peculiar presphenoid is characteristic of Crocodilia, and the osseous interorbital septum, of the Rhynchocephalia.

The position of the posterior plate of the squamosal in Ichthyopterygia and Anomodontia seemed conclusive as the homology of that element with the bone covering the cartilaginous quadratum in Batrachia Anura, and the osseous quadratum in Urodela and Dipnoi, called tympanique by Cuvier, and temporo-mastoidean by Dugés. This bone had been already homologized with the preoperculum of Teleostei by Huxley, and it is thought that its present determination in the Reptilia established the serial homology of the preoperculum of the fish with the squamosal plate of the mammal.

Prof. Kirkwood communicated a paper "On the Mass of the Asteroids between Mars and Jupiter." (See Proceedings below.)

Prof. Cresson described the thunder storm of the 4th inst. at the Belmont Water Works.

And the Society was adjourned.

On the MASS *of* ASTEROIDS *between* MARS *and* JUPITER. By PROFESSOR DANIEL KIRKWOOD, Bloomington, Indiana.

According to Leverrier, the total mass of the ring of minor planets does not exceed $\frac{1}{4}$th of the earth's mass, or $\frac{1}{1200}$th of that of Jupiter. So great a disproportion between two adjacent planets is without a parallel. Is the fact susceptible of a probable explanation?

Were the sun transformed into a gaseous spheroid with an equatorial radius equal to the diameter of the earth's orbit, a large number of the known asteroids would, in perihelio, plunge into the solar mass and be reunited with it. Now this, in all probability, is precisely what occurred soon after the abandonment of the asteroid zone, while the solar nebula was in the process of condensation. The powerful mass of Jupiter would produce great eccentricity in parts, at least, of the primitive ring. Large portions of its matter, or a considerable number of minor planets in a state of vapor, may thus have been precipitated upon the sun before the latter had contracted within their perihelion distance. The small mass of Mars may perhaps be accounted for on the same hypothesis.

A REGISTER *of* METEOROLOGICAL OBSERVATIONS *made at* BOIS CHÊNE, near Port-au-Prince, Hayti. By PROF. A. ACKERMAN, National Museum.

(*Read before the American Philosophical Society, July* 15, 1870.)

INTRODUCTORY REMARKS.

All the meteorological observations have been made at "Bois Chêne," S.E. from the harbor of the Capital, at an elevation of 52 meters above the mean level of the sea, with the exclusion of those comprised between the 19th May, 1866, to the 17th November, 1867, which have been made at "Lalue," suburb E of the Capital, country seat of General Lamothe, elevation 57 meters*

The rain-guage used is that of Babinet; its surface of reception is four square-decimeters, so that a centilitre of water represents $\frac{1}{4}$ millimeter of rain in elevation. No building, trees or other obstacles influenced the quantity of received rain, and in order to avoid a correction for evaporation, the water was measured after every rain, except what fell at night, which was registered before sunrise, and without having applied a correction. Elevation of the funnel above ground 3 feet.

The diurnal rain comprises that which fell between 6 o clock A. M. and 6 o'clock P. M., and nocturnal rain that which was received in the remaining twelve hours.

As to the division adopted for the electric phenomena of the atmosphere, the first column reproduces the number of days during which it thundered, and lightning was perceived; however, one phenomenon may have been independent of the other, for example: the thunder was heard in the morning, and the lightning seen in the evening of the same day; this day is noted in the first column. In order to diminish a sort of want of precision in this first column, the last column represents the days of "orages"† which passed above town or its near environs, notwithstanding they have already been counted in the first column. The number of days during which thunder alone was heard, or lightning only perceived, form the successive columns and can only be considered as minima, for the phenomena may have escaped observation, principally lightning at night.

There are days during which thundering lasts for hours, and others when lightnings are so numerous in the evenings as to amount from 30 to 80 in a minute of time, and so for several hours. Particulars about lightnings, on colors, numbers, bifurcations, multiple divisions, distances ascending and descending, &c., &c., have been published in the Moniteur Officiel of the Republic.

Relative to temperature, the thermometers are standard instruments, from the best makers in Paris, divided on the stem into $\frac{1}{5}$ centigrades, so that a tenth of a degree is easily estimated; from time to time the variation of zero-point was verified and the correction applied to the observations.

* "Lalue" and "Bois Chêne" are situated about a mile from the sea shore, and both stations near together, about $\frac{1}{5}$ part of a mile asunder.

† Thunder storm and rain.

The instruments have no frame, and are freely suspended without being shaken by the wind. The absolute minimum is given by a Rutherford spirit therm., and the absolute maximum by Negretti & Zambra's mercurial therm., both Salleron's construction at Paris.

The hourly observations of temperature are performed by "Breguet's thermometrographe horaire No. 6," [See Arago, not. scientif. vol. V, pp. 628–632, and Desains: physique, vol. I, page 247; or Daguin: phys. vol. II, page 546, etc.] This instrument having an arbitrary scale, it was compared with a standard therm. in two constant temperatures, and further checked by numerous simultaneous observations. Breguet's No. 6 acts in the most satisfactory manner, but is much more sensible than other thermometers, so that for the comparisons the instruments were read at a distance with the aid of a cathetometer, and further all the cares taken to obtain correctness, etc.

The exposure of all the instruments is as follows:

A square room of 14 feet a side, has openings towards the four cardinal points, a covered gallery on the South side, is without ceiling, covered with shingles, so that the air circulates freely day or night, from whatever direction the wind is blowing.

On the North side is the window furnished with latticed blinds, painted white, nearly of the same form as prescribed in the "Directions for meteorol. observ." Smithsonian Institution 1860, fig. 2. Elevation of thermometers above ground 10 feet.

The mean daily temperature (and consequently the mean monthly and annual) are the results of the 24 registered hourly observations. The given factor is the co-efficient by which the difference between the absolute maximum and minimum is to be multiplied, and the product added to the minimum, in order to obtain the same mean daily temperature as given by Breguet's hourly thermometrograph.

About ten personal observ. were made daily, with free thermom., psychrom., barometer, winds, clouds, &c., &c., besides the reading of the maxim and minim and the said thermometrograph, thermometer exposed to the sun, to nocturnal radiation, etc.

The second decimal of Fahrenheit degrees does not occur in observation, and is either the result of the mean addition or produced by the reduction of Centigrades into Fahrenheit degrees.

The barometers, Fortin's, had been compared with the barometer at the astron. observatory in Paris, and the makers had given the correction, a constant, for every one. Further, the observations were corrected for capillarity, the column reduced to the temperature of zero degree (32° Fahrenheit) and reduced to the mean level of the sea by the formula of Jamin, Cours de physique de l'école polytechnique, vol. I, end of page 263.

$$X = 18405^{m}\,(1 + 0.002552.\ \cos\ 2\ L)\left[1 + \frac{2\,(T + t)}{1000}\right] \log \frac{H}{h}\ ;$$

H & h being reduced to 0° C. X being known the value of H gave the pressure on the level of the sea.

Meteorological Station of Port au Prince.

Extracted from the Registers.

I. Rain and Electrical Phenomena.

1863.	Rain expressed in millim.			Number of days of observed.				Number of thunderstorms over the town or its environs.	
	total.	diurnal	nocturnal	rainy.	thunder & lightning.	thund'r alone.	lightn'g alone,	total.	nocturnal
Aug.	82.50	47.50	35.00	13	2	0	0	1	1
Sept.	128.00	16.25	111.75	17	17	0	2	3	2
Oct.	257.00	85.00	172.00	23	2	0	1	1	1
Nov.	91.50	27.25	64.25	13	1	0	1	1	1
Dec.	18.50	inappr.	18.50	6	0	0	0	0	0
	577.50	176.00	401.50	72	22	0	4	6	5
1864.									
Jan.	0.75	inappr.	0.75	2	0	0	0	0	0
Feb.	123.75	15.50	108.25	14	3	1	2	0	0
Marc.	110.75	0.00	110.75	11	0	0	0	0	0
April.	212.00	0.00	212.00	15	2	1	2	2	2
May.	260.75	133.00	127.75	17	5	1	1	1	1
June.	59.50	1.50	58.00	7	5	8	0	2	1
July.	108.75	45.25	63.50	14	8	6	0	3	2
Aug.	223.50	152.50	71.00	19	15	1	0	6	5
Sept.	164.25	11.50	152.75	13	20	2	0	9	1
Oct.	170.75	48.00	122.75	13	1	1	0	0	0
Nov.	61.00	17.00	44.00	13	2	0	0	2	2
Dec.	45.50	10.50	35.00	7	2	0	0	1	1
	1541.25	434.75	1106.50	145	63	21	5	26	15
1865.									
Jan.	20.40	4.00	16.40	5	0	0	0	0	0
Feb.	13.00	0.00	13.00	5	0	0	0	0	0
March.	77.75	0.00	77.75	12	0	0	0	0	0
April.	193.50	8.00	185.50	19	2	1	0	0	0
May.	451.25	157.75	293.50	24	17	4	0	4	2
June.	74.75	44.25	30.50	14	8	8	1	3	3
July.	103.00	38.00	65.00	10	7	2	0	4	3
Aug.	129.00	54.00	75.00	15	9	3	1	3	1
Sept.	298.25	131.75	166.50	20	11	8	1	3	1
Oct.	151.50	46.25	105.25	22	13	3	1	3	2
Nov.	158.50	14.50	144.00	9	4	2	4	1	1
Dec.	28.00	0.00	28.00	2	0	1	1	0	0
	1698.90	498.50	1200.40	157	71	32	9	21	13

II. Rain and Electrical Phenomena.—*Continued.*

1866.	Rain expressed in millim.			Number of days of observed.				Number of thunderstorms over the town or its environs.	
	total.	diurnal	nocturnal	rainy.	thunder & lightning.	thund'r alone.	lightn'g alone.	total.	nocturnal
Jan.	57.25	11.00	46.25	9	2	1	0	2	2
Feb.	75.50	12.00	63.50	12	2	2	1	1	1
March.	149.25	5.00	144.25	11	0	0	0	0	0
April.	362.25	inappr.	362.25	22	8	2	1	3	2
May.	226.50	57.00	169.50	18	13	1	1	7	5
June.	146.00	27.25	118.75	17	13	8	1	3	3
July.	150.50	96.50	54.00	15	13	10	1	6	2
Aug.	125.50	8.75	116.75	18	16	4	0	7	7
Sept.	131.50	37.50	94.00	20	20	3	3	6	5
Oct.	110.00	39.00	71.00	20	7	4	1	4	4
Nov.	125.50	83.25	42.25	11	1	0	0	0	0
Dec.	56.25	inappr.	56.25	6	0	0	1	0	0
	1716.00	377.25	1338.75	179	95	35	10	39	31
1867.									
Jan.	51.25	0.00	51.25	4	0	0	0	0	0
Feb.	26.75	5.00	21.75	9	2	0	0	1	0
March.	22.75	2.00	20.75	5	1	1	1	0	0
April.	199.50	14.75	184.75	13	6	0	0	0	0
May.	322.75	60.00	262.75	17	13	2	2	5	3
June.	177.00	28.25	148.75	17	11	7	0	2	1
July.	54.25	41.50	12.75	9	13	1	4	2	0
Aug.	138.75	47.25	91.50	15	15	8	0	4	4
Sept.	52.75	28.25	24.50	7	14	1	6	2	2
Oct.	126.75	3.75	123.00	12	17	3	1	2	2
Nov.	63.25	19.50	43.75	15	7	2	3	2	1
Dec.	41.50	0.00	41.50	3	0	0	1	0	0
	1277.25	250.25	1027.00	119	99	25	18	20	13
1868.									
Jan.	0.50	0.25	0.25	2	0	0	1	0	0
Feb.	143.25	1.25	142.00	17	7	0	3	1	1
March.	86.75	10.00	76.75	15	1	0	0	0	0
April.	102.00	47.00	55.00	15	4	0	0	0	0
May.	317.50	115.00	202.50	25	17	4	1	6	5
June.	52.00	47.75	4.25	14	6	10	0	1	1
July.	42.75	14.00	28.75	13	14	2	12	5	2
Aug.	129.50	43.50	86.00	13	18	3	5	7	6
Sept.	282.00	151.00	131.00	24	21	4	0	16	12
Oct.	118.00	13.75	104.25	14	10	5	3	1	1
Nov.	117.75	29.00	88.75	17	8	1	2	3	2
Dec.	43.00	20.00	23.00	10	0	0	1	0	0
	1435.00	492.50	942.50	179	106	29	28	40	30

III. Rain and Electrical Phenomena—*Continued.*

1869.	Rain expressed in millim.			Number of days of observed.				Number of thunder-storms over the town or its environs.		
	total.	diurnal	nocturnal.	rainy.	thunder & lightning.	thund'r alone.	lightn'g alone.	total	nocturnal	
Jan.	26.75	15.00	11.75	9	1	0	0	0	0	
Feb.	141.00	7.50	133.50	12	2	0	1	1	1	
March.	108.75	5.50	103.25	14	1	1	0	1	1	
April.	123.25	inap.	123.25	17	5	1	0	0	0	
May.	326.25	105.00	221.25	18	15	3	0	7	5	
June.	139.25	64.50	74.75	12	18	4	1	9	4	
July.	97.50	48.50	49.00	16	21	5	0	8	1	
Aug.	265.50	158.25	107.25	22	21	7	0	10	3	
Sept.	267.25	31.25	236.00	22	19	5	2	7	6	
Oct.	151.50	25.00	126.50	18	17	4	4	6	6	
Nov.	28.75	6.00	22.75	7	4	1	3	0	0	
Dec.	6.00	1.00	5.00	3	0	0	1	0	0	
	1681.45	467.50	1214.25	170	124	31	12	48	27	
					a	b	c			Days of electric phenom. a, b, c.
1864	1541.25	434.75	1106.50	145	63	21	5	26	15	89
1865	1698.90	498.50	1200.40	157	71	32	9	21	13	112
1866	1716.00	377.25	1338.75	179	95	35	10	39	31	140
1867	1277.25	250.25	1027.00	119	99	25	18	20	13	142
1868	1435.00	492.50	942.50	179	106	29	28	40	30	163
1869	1681.45	467.50	1214.25	170	124	31	12	48	27	167

The remarkable increase of days of electric phenomena is not yet accounted for. Nothing has been changed in the mode of observing, or hours of observing, and all are personal observations. I may add, that for the last four years agriculture has been neglected in the mountains surrounding the town.

	Mean value of a rainy day in millim.						
	1863.	1864.	1865.	1866.	1867.	1868.	1869.
January,		0.37	4.08	6.36	12.81	0.25	2.97
February,		8.35	2.60	6.30	2.98	8.43	11.75
March,		10.07	6.48	13.57	4.55	5.78	7.77
April,		14.13	10.08	16.47	15.35	6.80	7.25
May,		15.34	18.80	12.58	18.98	12 70	18.12
June,		8.50	5.34	8.56	10.41	3.71	11.60
July,		7.77	10.30	10.03	6.03	3.29	6.10
August,	6.35	11.76	8.60	6.97	9.25	9.96	12.06
September,	7.53	12.63	14.90	6.57	7.53	11.75	12.15
October,	11.17	13.13	6.90	5.50	10.56	8.43	8.42
November,	7.00	4.70	17.60	11.40	4.21	6.93	4.11
December,	3.08	6.50	14.00	9.25	13.83	4.30	2.00

THE MOST RAINY DAY OF EVERY MONTH SINCE THE 1ST OF AUGUST, 1863.

	1863.				1864.				1865.			
	Date.	Diurnal or not.	Duration	Millim.	Date.	Diurnal or not.	Duration	Millim.	Date.	Diurnal or not.	Duration	Millim.
January,					31			0.75	12	n		7.00
February,					25	n		27.00	4	n		9.00
March,					16	n		58.00	23	n		24.00
April,					20	n	130 min.	58.00	23	n		40.00
May,					4	n		62.00	25	d and n	24 hours.	142.00
June,					28	n		43.00	20	d and n		22.00
July,					16	n		30.00	9	n		33.00
August,	3	d	32 min.	32.00	24	n		46.75	15	n		36.00
September,	18	n		37.75	3	n		35.00	24	n		80.00
October,	12	n		38.00	4	n	4 hours.	62.00	27	n		42.25
November,	2	n		17.50	25	d		13.50	21	d and n		59.25
December,	8	n		8.00	23	n		17.50	1	n		28.00

THE MOST RAINY DAY OF EVERY MONTH SINCE THE 1ST OF AUGUST, 1863—*Continued.*

	1866.				1867.				1868.				1869.			
	Date.	Diurn'l or not.	Duration	Millim.	Date.	Diurn'l or not.	Duration	Millim.	Date.	Diurn'l or not.	Durat'n	Millim.	Date.	Diurn'l or not.	Durat'n	Millim.
January,	17	n		17.25	7	n		34.75	19	d	1	0.25	28	d		7.50
February,	26	n	30 min.	23 75	9	n		12.00	26	n	135 min.	38.00	28	n		67.00
March,	31	n		36.75	14	n		15.00	12	n	45 min.	15.00	17	n		44.75
April,	1	n	105 min.	58.00	23	n		58.00	11	n	105 min.	36.00	9	n		60.00
May,	17	n		56.50	9	n		73.50	17	n	120 min.	57.00	9	d & n		134.00
June,	12	n		65.50	9	n		72.50	9	d	55 min.	13.00	22	d		*60.00
July,	15	d & n	4 h. 30 m.	48.00	4	d & n		31.50	3	n		11.00	20	n		20.00
August,	30	n	2 h.	23.25	22	n		33.25	22	n	55 min.	47.00	19	d & n		34.00
September,	2	n	1 h.	26.00	7	d		19.25	17	d	120 min.	64.00	13	n		72.00
October,	31	n		21.75	6	n		33.75	18	n		61.25	8	n		52.00
November,	25	d	3 h. 30	86.75	10	d	135 min.	16.00	7	d & n	90 min.	35.75	12	n		14.75
December,	21	n	2 h. 30	22.00	15	n		22.25	18	d		10.50	2	n		4.00

* Rain and hailstones.

Temperature.

	1864.							1865.						
	Mean monthly.	Monthly mean of minim.	Monthly mean of maxim.	Lowest minim.	Highest maxim.	Mean amplit'd.	Extreme amplit'd.	Mean monthly.	Monthly mean of minim.	Monthly mean of maxim.	Lowest minim.	Highest maxim.	Mean amplit'd.	Extreme amplit'd.
	°							°						
Jan.	75.74							77.48						
Feb.	75.38							75.56						
March.	76.82							77.90						
April.	78.35							78.26						
May.	77.54							79.95						
June.	81.60							81.78	°	°	°	°	°	°
July.	81.86							82.10	73.58	92.12	71.24	95.00	18.54	23.76
Aug.	80.87							81.94	73.58	91.04	69.80	97.34	17.46	27.54
Sept.	81.14							78.89	71.60	88.34	67.64	92.30	16.74	24 66
Oct.	80.42							79.88	71.96	88.34	68.54	91.04	16.38	22.50
Nov.	77.45							77.42	70.70	86.00	68.36	90.14	15.30	21.78
Dec.	75.65							77.10	68.00	86.00	65.12	88.88	18.00	23.76

	1866.							1867.						
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Jan.	74.93	66.38	84.02	56.84	88 34	17.64	31.50	75.08	66.02	85.82	59.90	90.50	19.80	30.60
Feb.	77 00	68.18	86.54	63.68	89.96	18.36	26.28	76.50	66.56	87.80	61.88	91.04	21.24	29.16
March.	74.94	66.92	83.12	60.08	88.88	16.20	28.80	77.60	68.90	89 24	64.76	95.00	20.34	30.24
April.	77.10	68.54	85.64	66 38	89.60	17.10	22.22	79.55	70.52	90.68	67.64	95.36	20.16	27.72
May.	79.12	68.54	86.00	68.36	91.40	17.46	23.04	79.56	71.78	88.88	68.00	92.84	17.10	24.84
June.	80.30	72.32	90.32	69.08	95.90	18.00	26.82	80.37	72.50	91.22	68.36	95.00	18.72	26 64
July.	80.96	72.14	89.78	69.08	97.16	17.64	28.08	81.10	73.58	93.56	70.16	98.06	19.98	27.90
Aug.	82.05	73.58	92.48	69.44	98 24	18.90	28.80	81.63	73.22	93.56	70.16	97 70	20.34	27.54
Sept.	79.97	71.96	90.14	69.80	94.64	18.18	24.84	81.38	72.86	92.30	69.80	96.80	19.44	27.00
Oct.	78.92	71.96	88.88	69.80	93.20	16.92	23.40	80.80	69.98	90.68	69.80	96.80	20.70	27.00
Nov.	76.88	69.44	86.18	64.76	90.86	16.71	26.10	77.48	69.80	86.72	61.88	90.86	16.92	28.98
Dec.	75.20	67.28	86.00	59.72	90.32	18.72	30.60	76 30	65.84	88.16	57.20	90.50	22.32	33.30

Temperature—*Continued.*

	1868.							1869.						
	Mean monthly.	Monthly mean of minim.	Monthly mean of maxim.	Lowest minim.	Highest maxim.	Mean amplit'd.	Extreme amplit'd.	Mean monthly.	Monthly mean of minim.	Monthly mean of maxim.	Lowest minim.	Highest maxim.	Mean amplit'd.	Extreme amplit'd.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Jan.	76.46	64.94	88.70	56.48	93.20	23.76	36.72	76.60	66.38	88.52	59.36	91.40	22.14	32.04
Feb.	75.92	66.56	87.26	62.24	92.30	20.70	30.06	77.58	68.00	88.11	63.50	92.84	20.11	29.34
March.	76.43	67.64	86.36	62.60	91.40	18.72	28.80	77.27	69.28	86.72	64.22	92.30	17.44	28.08
April.	79.33	68.18	90.32	65.30	96.44	22.14	31.14	81.89	70.77	90.21	66.38	95.54	19.44	29.16
May.	78.87	68.36	89.96	67.10	94.10	21.60	27.00	81.69	71.69	91.01	66.74	97.70	19.32	30.96
June.	81.42	71.78	92.48	68.72	98.06	20.70	29.34	82.40	72.14	93.38	67.46	98.24	21.24	30.78
July.	83.84	75.74	95.36	70.34	100.40	19.62	30.06	81.54	71.65	93.54	68.00	98.24	21.89	30.24
Aug.	82.61	73.22	94.82	68.72	100.40	21.60	31.68	80.61	71.50	90.43	67.82	93.20	18.93	25.38
Sept.	78.71	71.24	89.06	67.64	94.64	17.82	27.00	80.96	71.93	89.85	69.62	93.74	17.92	24.12
Oct.	79.35	69.26	88.34	69.26	92.30	19.08	23.04	80.06	71.55	88.63	68.72	91.40	17.08	22.68
Nov.	76.91	68.90	86.72	61.52	91.40	17.82	29.88	78.19	69.46	88.07	64.04	91.40	18.61	27.36
Dec.	75.83	66.74	87.26	61.70	90.86	20.52	29.16	75.52	65.87	87.33	60.44	91.40	21.46	30.96

Mean Monthly Temper. of 6 years.

	°
January,	76.01
February,	76.32
March,	76.82
April,	79.09
May,	79.45
June,	81.39
July,	81.90
August,	81.63
September,	80.70
October,	79.90
November,	77.38
December,	75.94

Mean Annual Temperature.

	°
1864	78.57
1865	79.00
1866	78.12
1867	78.94
1868	78.80
1869	79.52
Mean annual of 6 years,	78.82

The Lowest and Highest Mean Daily Temperature for Every Month.

	1864.		1865.		1866.		1867.		1868.		1869.	
	lowest.	highest.	lowest.	highest.	lowest.	highest.	lowest.	highest.	lowest.	highest.	lowest.	highest.
January,	73°.22	78°.44	73°.40	80°.51	69°.44	78°.98	72°.55	78°.17	73°.04	79°.66	72°.36	78°.84
February,	72.14	77.90	71.60	78.44	72.23	79.25	74.01	78.44	72.91	79.11	75.36	80.26
March,	73.40	79.70	76.64	80.24	68.54	78.26	75.99	80.76	71.42	79.88	73.45	79.75
April,	75.92	80.42	74.66	80.06	74.12	80.06	77.72	81.67	75.43	84.06	78.16	84.11
May,	78.40	80.42	75.56	83.39	75.56	81.50	76.24	81.05	76.82	81.05	74.70	86.07
June,	77.99	84.99	79.88	85.10	77.90	82.76	76.86	85.59	75.22	85.59	78.63	85.35
July,	78.15	85.32	77.99	84.65	78.08	83.66	78.04	85.95	78.08	86.11	78.06	85.57
August,	77.63	85.10	78.62	86.18	78.08	84.65	74.17	84.92	79.70	86.77	77.88	83.53
September,	78.62	84.11	75.11	81.41	76.82	83.51	76.01	84.20	75.94	81.39	79.26	83.21
Obtober,	74.39	81.86	77.18	81,23	77.02	81.50	78.26	84.38	75.83	82.96	77.76	81.64
November,	74.07	80.45	75.74	79.70	74.06	79.50	73.74	80.92	72.09	79.75	75.88	79.77
December,	72.65	78.35	73.94	80.06	71.06	78.33	71.78	79.88	73.40	77.90	72.63	77.99

Mean Monthly Temperatures for every hour—Year 1868.

	mid-night	h 13	h 14	h 15	h 16	h 17	h 18	h 19	h 20	h 21	h 22	h 23	noon.	h 1	h 2	h 3	h 4	h 5	h 6	h 7	h 8	h 9	h 10	h 11	mid-night
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January,	71.24	70.70	69.62	68.72	68.00	67.46	67.28	68.36	73.40	77.00	81.86	84.38	85.64	86.18	86.54	86.18	84.92	82.22	79.16	76.46	75.38	74.30	73.40	72.50	71.24
February,	71.60	70.70	69.80	69.08	68.72	68.18	67.28	68.00	73.58	77.00	80.24	82.40	84.02	84.38	84.20	83.66	83.30	80.42	78.44	77.00	75.92	74.84	73.76	72.86	71.60
March,	72.68	71.96	71.78	71.06	70.52	69.62	68.90	70.52	75.02	78.08	80.24	82.40	83 66	83.66	83.84	83.30	82.40	80.78	78.44	76.46	74.84	74.30	74.12	73.40	72.68
April,	75.38	74.84	74.30	73.58	73.04	72.50	71.42	73.58	79.16	81.86	83.84	85.46	86.90	86.54	86.72	86.18	85.46	82.76	83.30	78.80	77.54	76.82	76.28	75.92	75.38
May,	74.12	73.40	72.68	72.14	71.78	71.42	71.24	76.10	80.06	82.94	84.74	86.00	86.18	85.28	85.64	86.00	84.56	83.84	82.22	79.52	77.72	76.46	75.20	74.48	73.94
June,	77.18	76.46	75.74	74.66	74.12	73.58	73.76	77.72	81.68	84.38	86.54	87.98	89.06	89.60	89.24	88.34	87.44	86.36	84.20	81.50	80.24	79.52	78.80	78.08	77.36
July,	80.78	80.06	79.34	77.90	77.42	77.18	77.00	79.34	82.94	85.64	88.34	90.32	91.58	92.12	91.94	91.40	89.96	88.16	86.00	82.58	81.50	80.60	79.70	78.80	77.90
August,	77.72	77.00	76.28	75.74	75.02	74.48	73.94	77.36	82.04	86.18	88.88	90.32	91.04	90.68	90.86	90.32	89.24	87.62	85.28	82.58	81.14	79.70	78.98	78.26	77.54
September,	74.66	74.30	73.94	77.22	72.86	72.50	71.78	73.40	77.72	81.14	84.02	85.64	86.54	86.18	85.46	85.10	84.56	83.66	80.60	78.44	76.82	76.10	75.56	75.02	74.30
October,	76.28	75.92	75.38	74.66	73.94	73.22	72.14	73.22	77.18	80.78	83.48	85.46	86.72	86.90	86.90	86.18	85.28	84.20	81.14	79.52	78.44	77.54	77.18	76.82	76.28
November,	73.40	73.22	72.68	72.32	71.96	71.06	70.16	70.16	74.30	77.54	80.24	82.40	83.84	84.74	84.38	83.84	83.30	80.96	78.44	76.28	75.20	74.30	74.12	73.58	73.22
December.	72.14	71.96	71.42	70.70	70.16	69.80	68.18	69.08	72.14	76.28	79.52	82.22	83.84	84.56	84.74	83.30	82.40	80.78	77.36	75.92	74.66	73.40	73.04	72.32	72.14
	74.76	74 21	73.58	72.81	72.29	71.75	71.09	73.07	77.44	80.74	83.49	85.41	86.59	86.74	86.70	86.15	85.24	83.48	81.21	78.75	77.45	76.49	75.84	75.17	74.46

Unusual days. Temperature of days entirely rainy.

	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1867. August 27.	75.02	74 30	74.30	74.84	75.20	75.56	76.28	76.64	74.48	73.94	73.94	74.30	73.76	73.76	73.94	73.94	73.76	73.76	73.40	73.04	72.68	72.68	72.68	72.68	72.32
" September 10.	81.50	80.06	81.32	81.14	81 68	81.86	75.92	74.30	73.22	75.20	77.00	77.36	78.98	78.08	75.74	74.48	74.12	73.40	72.68	73.04	72.68	72.50	72.50	71.96	72.14
1868. June 4.	75.20	75.56	75.56	75.20	75.20	75.02	74.30	73.36	74.48	74.66	75.38	74 12	74.48	75.02	76.46	76.46	76.68	76.28	74.30	74.30	74.66	75.20	75.38	75.74	75.74

Mean Monthly Factors for obtaining the Mean Daily Temperature with the Absolute Maxim. and Minim. only.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1865	0.5322	0.4452	0.4019	0.4586	0.4698	0.4645	0.4790	0.4792	0.4322	0.4272	0.4429	0.4797	0.4594
1866	0.4803	0.4782	0.5026	0.4473	0.4610	0.4440	0.4404	0.4580	0.4451	0.4064	0.4366	0.4241	0.4520
1867	0.4496	0.4706	0.4580	0.4476	0.4545	0.4265	0.4356	0.4180	0.4363	0.4775	0.4415	0.4627	0.4482
1868	0.4790	0.4562	0.4667	0.4446	0.4829	0.4620	0.4138	0.4410	0.4173	0.4933	0.4549	0.4341	0.4538
1869	0.4626	0.4778	0.4775	0.5753	0.5516	0.4832	0.4503	0.4749	0.5013	0.4878	0.4651	0.5141	0.4935
Mean of 5 years.	0.4807	0.4656	0.4611	0.4747	0.4840	0.4560	0.4438	0.4542	0.4464	0.4584	0.4482	0.4629	0.4613

The above factors have been calculated for every day in the year, and the mean taken for every month.

If the absolute daily maxim. and minim. are taken only, their half-sum will not represent the true mean daily temperature. The following well-known formula will represent it: (Max—Min) × f + min. = mean daily.

Breguet's instrument having given the mean daily temperature by 24 equidistant observations, and the absolute maxim. and minim. having also been observed, the factor f was obtained by the formula.

$$f = \frac{(\text{mean}-\text{min.})}{(\text{maxim.}-\text{min.})}$$

Highest temperature observed since 1859. 100°.40 on the 15th August, 1868, between $^{h}0$ and $^{h}1$.
Lowest do do do 56.48 on the 28th Jan. 1868, at 6 o'clock, A. M.

Greatest difference observed between free temperature and exposed to sun, 22° 32.

Highest temperature exposed to the sun observed, 115° 16, 1866, August 1st., the free temperature being 94°64, at the same time a thermometer with ivory scale, lying on a piece of board, marked 120°.

Greatest difference observed between free temperature and exposed to radiation at night, 10° 45.

MEAN ATMOSPHERIC PRESSURE AT NOON, DEDUCED FROM EVERY DAY'S OBSERVATIONS MADE AT NOON, AND REDUCED AS STATED IN THE INTRODUCTORY REMARKS.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean Annual at Noon.
1865	763.19	764.33	764.09	762.90	761.70	762.82	763.33	761.72	761.14	760.36	761.19	763.06	762.48
1866	4.39	4.74	4.39	3.41	2.09	3.25	3.20	2.35	2.32	0.03	1.41	3.10	2.89
1867	4.14	4.31	3.32	2.76	1.75	2.04	3.07	2.06	2.02	0.83	2.47	3.54	2.69
1868	4.12	3.75	3.62	3.80	2.58	2.99	3.24	2.84	2.07	1.40	1.59	3.80	2.98
1869	3.31	3.50	4.28	3.53	2.36	3.58	3.70	2.63	1.95	0.89	1.80	2.43	2.83
Mean of 5 yrs.	763.83	764.12	763.94	763.28	762.10	762.93	763.31	762.32	761.90	760.70	761.89	763.19	762.77

Mean Annual Barometrical Oscillation, 10.50 m.m.
Greatest oscillation in five years occurred in 1866, 13.94 m.m.

MEAN DAILY VARIATION, 1867, 1866, 1865, FOR EVERY MONTH COMPARED WITH NOON, IN MILLIMETERS.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Max. of A. M.	+ 1.47	+ 1.46	+ 1.28	+ 1.06	+ 0.90	+ 0.87	+ 0.75	+ 1.00	+ 1.08	+ 1.30	+ 1.34	+ 1.53
Minim. of P. M.	— 1.49	— 1.60	— 1.52	— 1.46	— 1.33	— 1.19	— 1.04	— 1.09	— 1.13	— 1.09	— 1.12	— 1.15
Mean Daily Ampl.	2.96	3.06	2.80	2.52	2.23	2.06	1.79	2.09	2.21	2.39	2.46	2.68

Monthly Amplitude of Atmospheric Pressure.

	Highest stand of Barometer.			Lowest stand of Barometer.			millim. monthly amplitude.	Remarks.
	date.	hour.	millimeter.	date.	hour.	millimeter.		
1865.								
Jan.	31	10 h A M	767.19	23	3 h P M	759.61	7.58	
Feb.	23	9½ "	767.33	20	5 "	760.15	7.18	
March.	13	10 "	767.70	24	4 "	760.30	7.40	
April.	21	9 "	767.00	26	4 "	758.91	8.09	
May.	5	9 "	764.83	23	4 "	757.33	7.50	
June.	28	9½ "	764.75	19	4 "	760.40	4.35	
July.	7	9 P M	765.70	5	3 "	761.07	4.63	
Aug.	30	9½ A M	763.75	16	4 "	758.85	4.90	
Sept.	4	8 h P M	764.07	28	5 "	758.73	5.34	
Oct.	31	10 h A M	763.39	2	4½ "	758.00	5.39	
Nov.	20	9½ "	763.85	10	4 "	758.19	5.66	
Dec.	18	9 "	766.59	6	4 "	759.69	7.03	
1866.								
Jan.	12	9¾ h A M	769.10[1]	26	3½ h P M	760.78	8.32	[1] The highest barom. stand observed between 1863 to 1870.
Feb.	17	9 "	768.80	11	4 "	761.28	7.52	
Mar.[2]	12	9½ "	767,13[3]	31	3¾ "	762.10	5.03	[2] Mar. 4 days without barom. observations
April.	1	9 "	765.10[4]	18	4¼ "	760.98	3.92	[3] On some days the max. A M unobserved
May.	6	9½ "	764.36[5]	25	4¼ "	758 81	5.55	[4] Same remark.
June.	29	10 "	764.75	23	3½ "	760.45	4.30	[5] Same rema. k.
July.	21	10 "	765.07	3	3¾ "	760.49	4.58	
Aug.	6	10 "	764.83	30	3¼ "	758.56[6]	6.27	
Sept.	8	10 "	764.83	30	1¼ "	755.16	9.67	[6] The lowest stand between 1863 to 18.0.
Oct.	14	9¼ "	762 65	7	4¼ "	757.95	4.70	Great hurricane U. S. coast.
Nov.	3	10 "	763.95	6	3¼ "	757.70	6.25	
Dec.								
1867.								
Jan.	28	8¾ h A M	768 06	20	3 h P M	758.74	9.32	
Feb.	1	7 "	767.00	15	4½ "	760.50	6.50	
March.	5	9½ "	766.05	22	4 "	759.85	6.20	
April.	14	9½ "	765.54	22	4 "	759.47	6.07	
May.	12	10 "	763.33	8	4 "	758.60	4.73	
June.	28	9 "	765.86	9	4 "	758.50	7.36	
July.	6	9 "	765.34	30	0¼ "	759.38	5.96	
Aug.	11	6½ "	764.75	3	4¾ "	759.64	5.11	
Sept.	30	7½ "	763.81	7	3¼ "	759.82	3.99	
Oct.	1	7½ "	764.62	14	4 "	757.47	7.15	
Nov.[7]	5	7¾ "	766.42	9	3¼ "	760.19	6.23	[7] From 23 to 28 Nov. no barom. observat.
Dec.	21	9½ "	766.37	12	3¼ "	760.72	5.65	

Certif. ten pages to be conform to the registers of the Meteorological Station of Port-au-Prince.

Prof. A. Ackerman.

Cartes de Visite of members for the Album of the Society, will be received with acknowledgments.